READING INTO THE SEISMIC TRACE:

Seismic attribute mapping in Service Contract 6A

Offshore NW Palawan Basin, Philippines

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THE PHILODRILL CORPORATION

GEOCON 2019
December 4 – 5
Manila Hotel, Philippines

OUTLINE

BACKGROUND

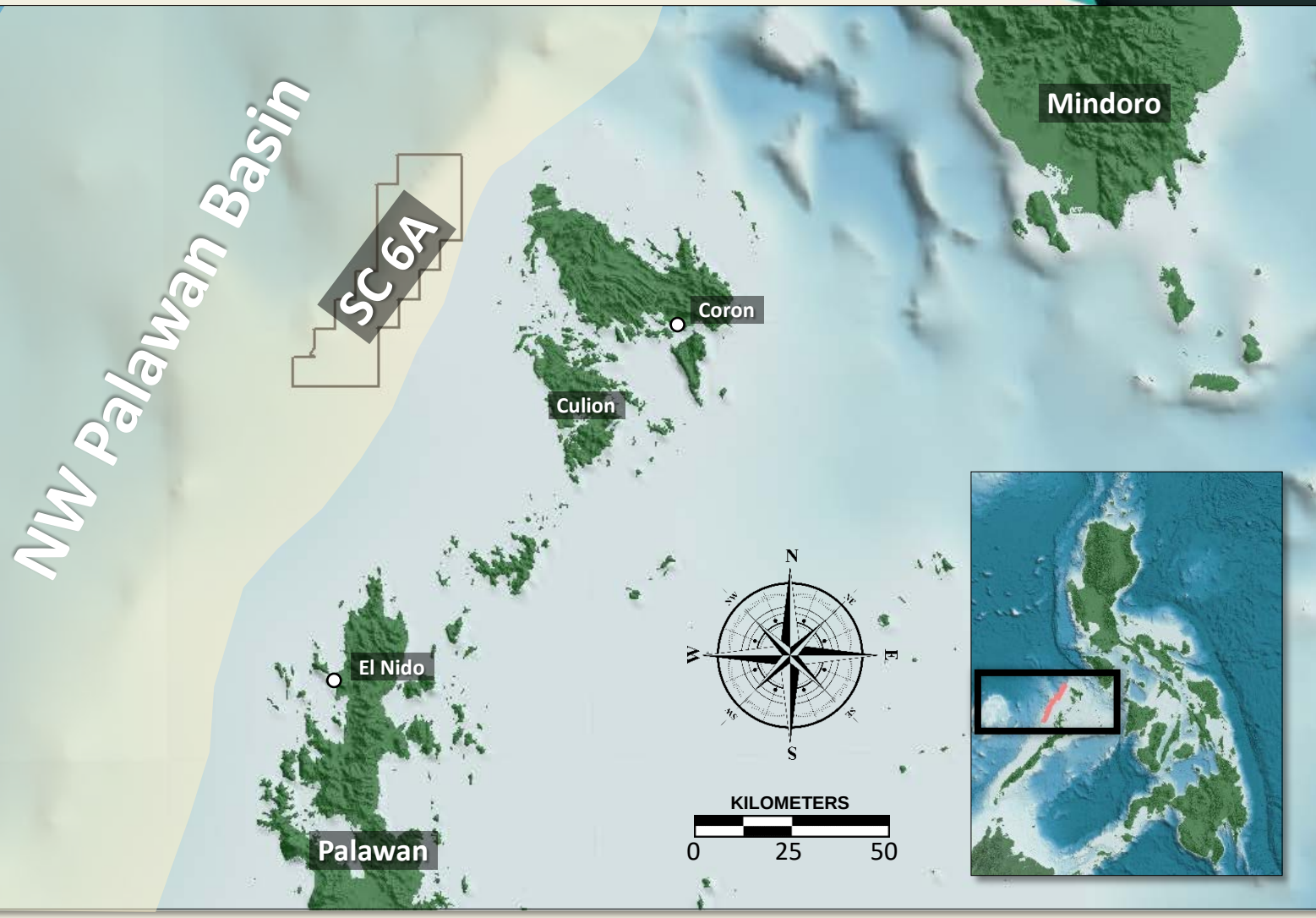
- SC 6A Petroleum System

SEISMIC INTERPRETATION

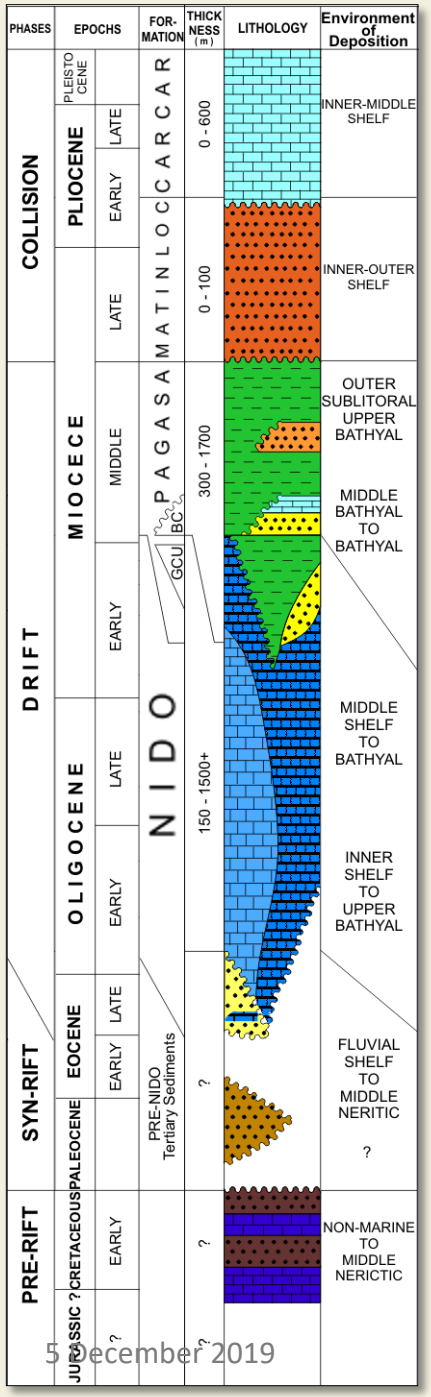
SEISMIC ATTRIBUTES

- Amplitude
- Spectral Decomposition
  - Theory
  - Results

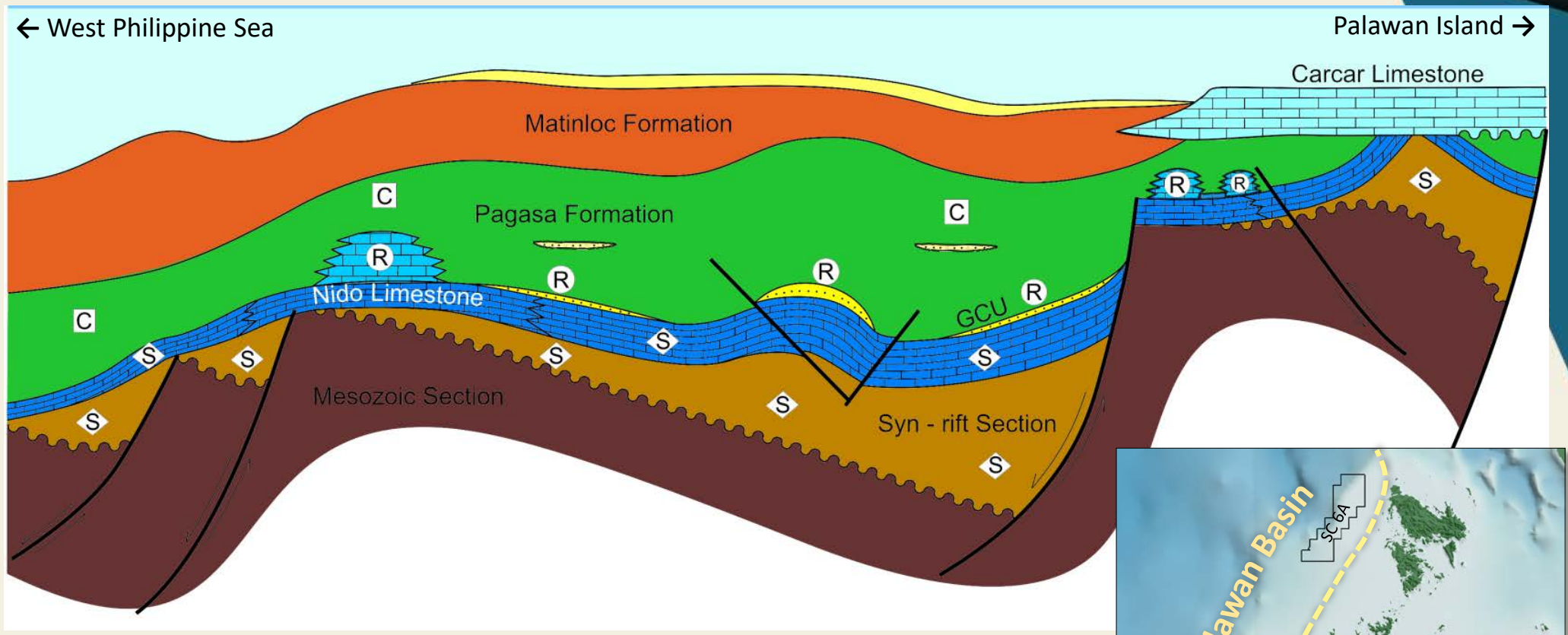
CONCLUSIONS

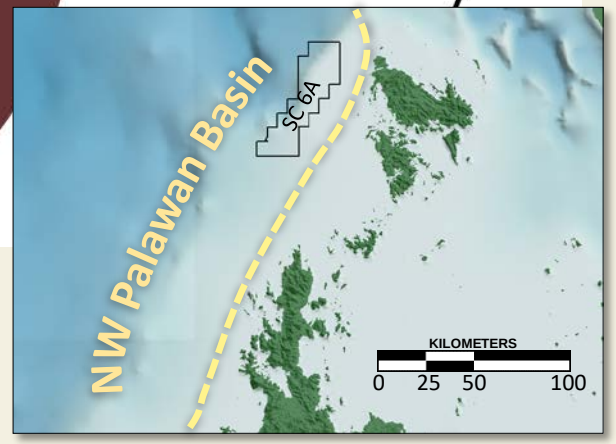


NW PALAWAN PETROLEUM SYSTEM



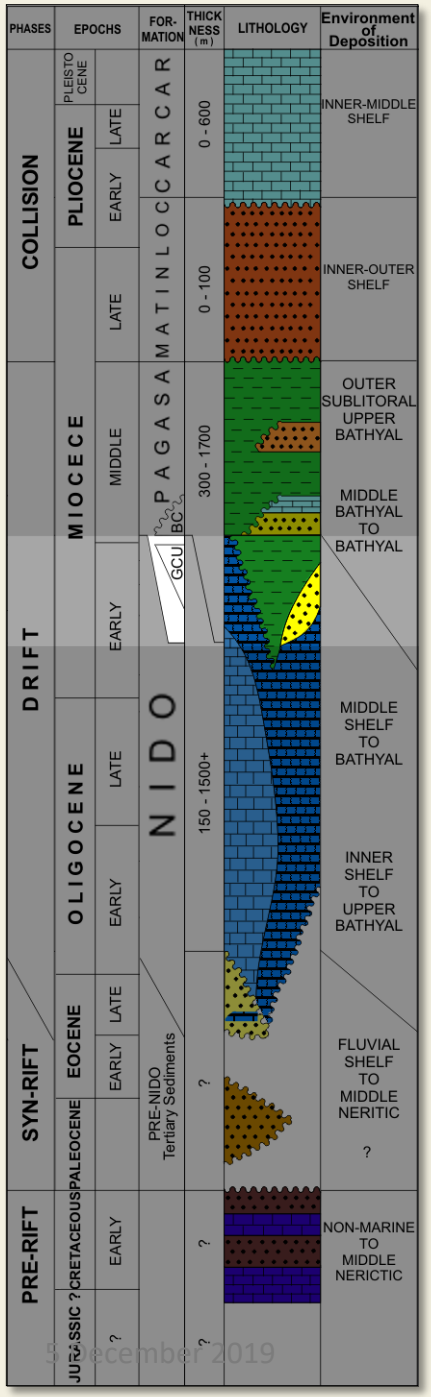
Schematic diagram of the NW Palawan Petroleum System
(Philodrill, 2014; modified from PhilPRA, 2002)





Ⓢ Source Rock
Ⓡ Reservoir Rock
[C] Cap Rock

NW PALAWAN PETROLEUM SYSTEM



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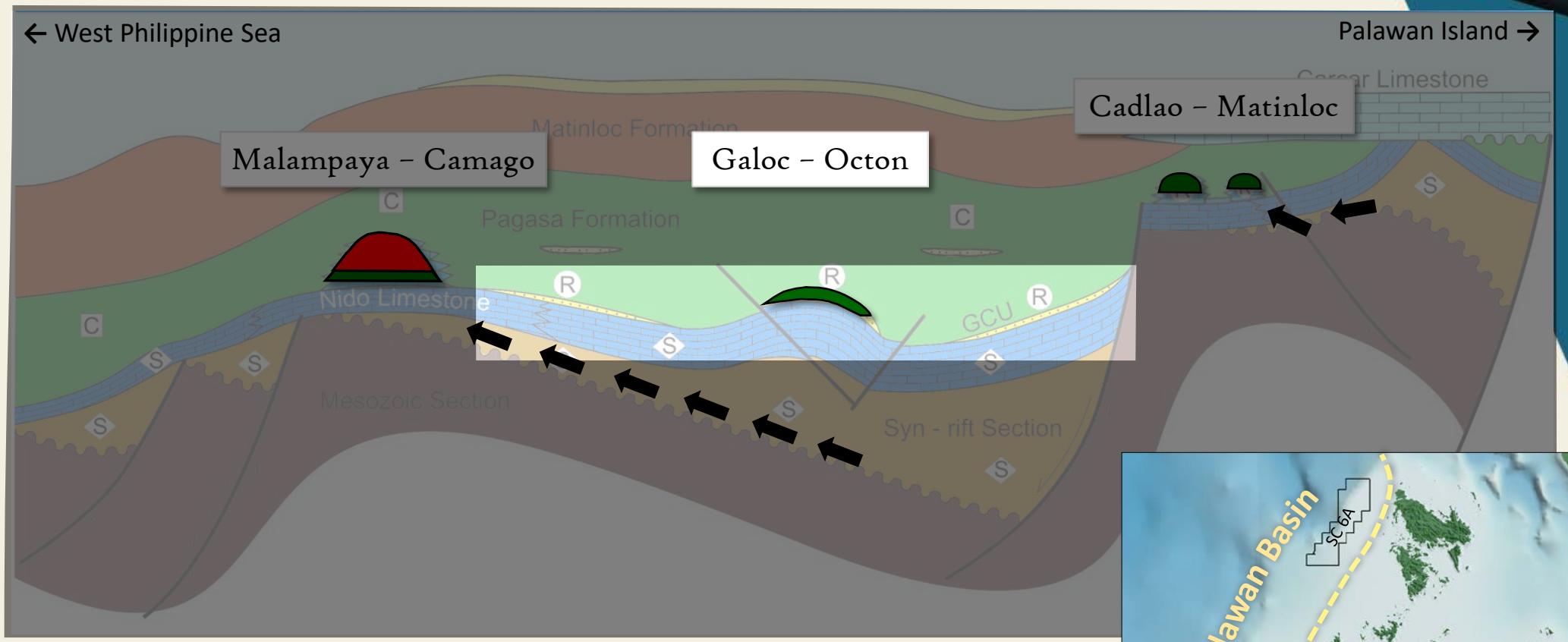
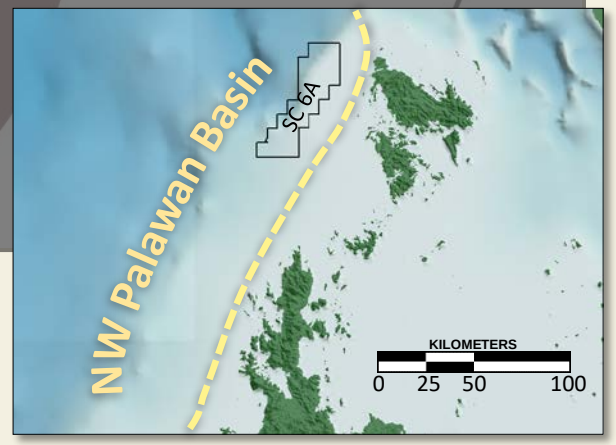
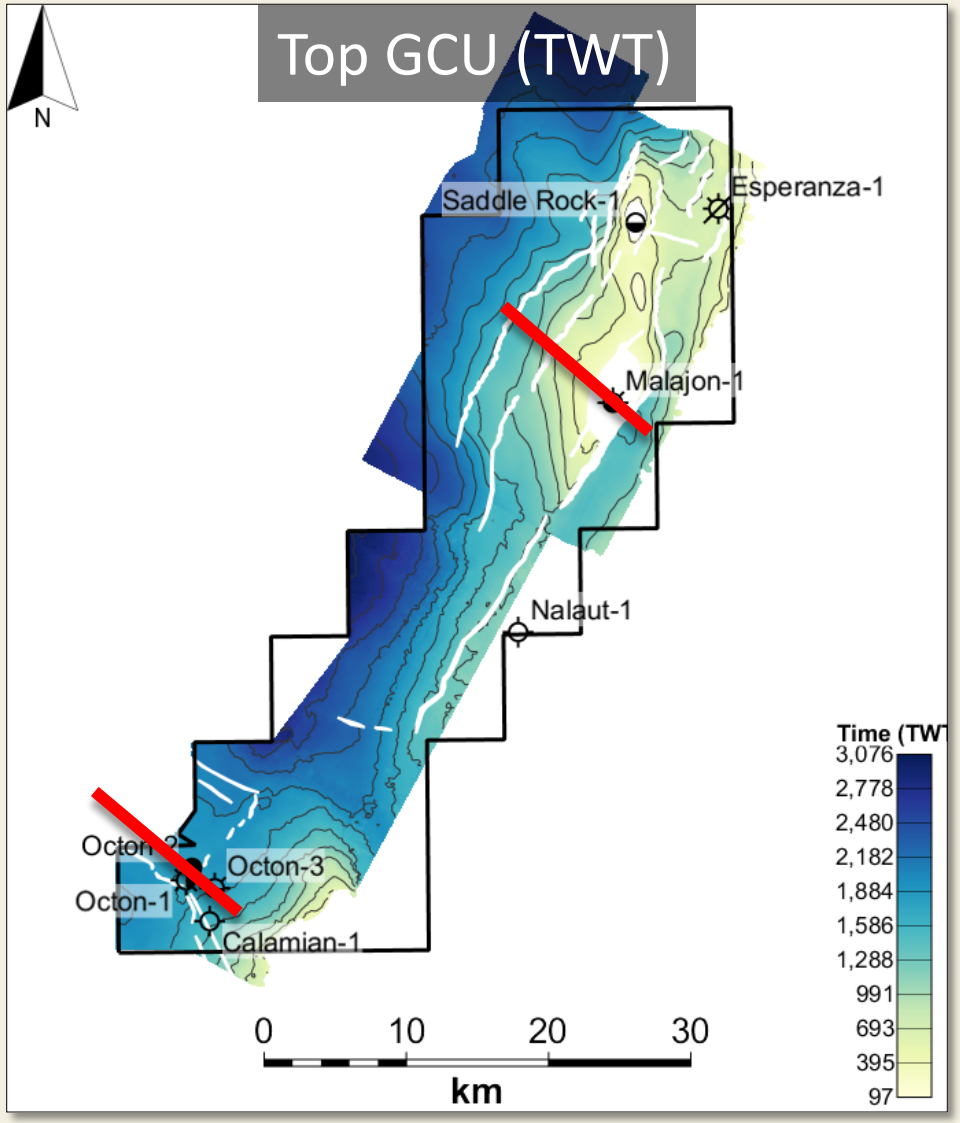




Source Rock
Reservoir Rock
Cap Rock
Migration
Gas
Oil

SEISMIC INTERPRETATION



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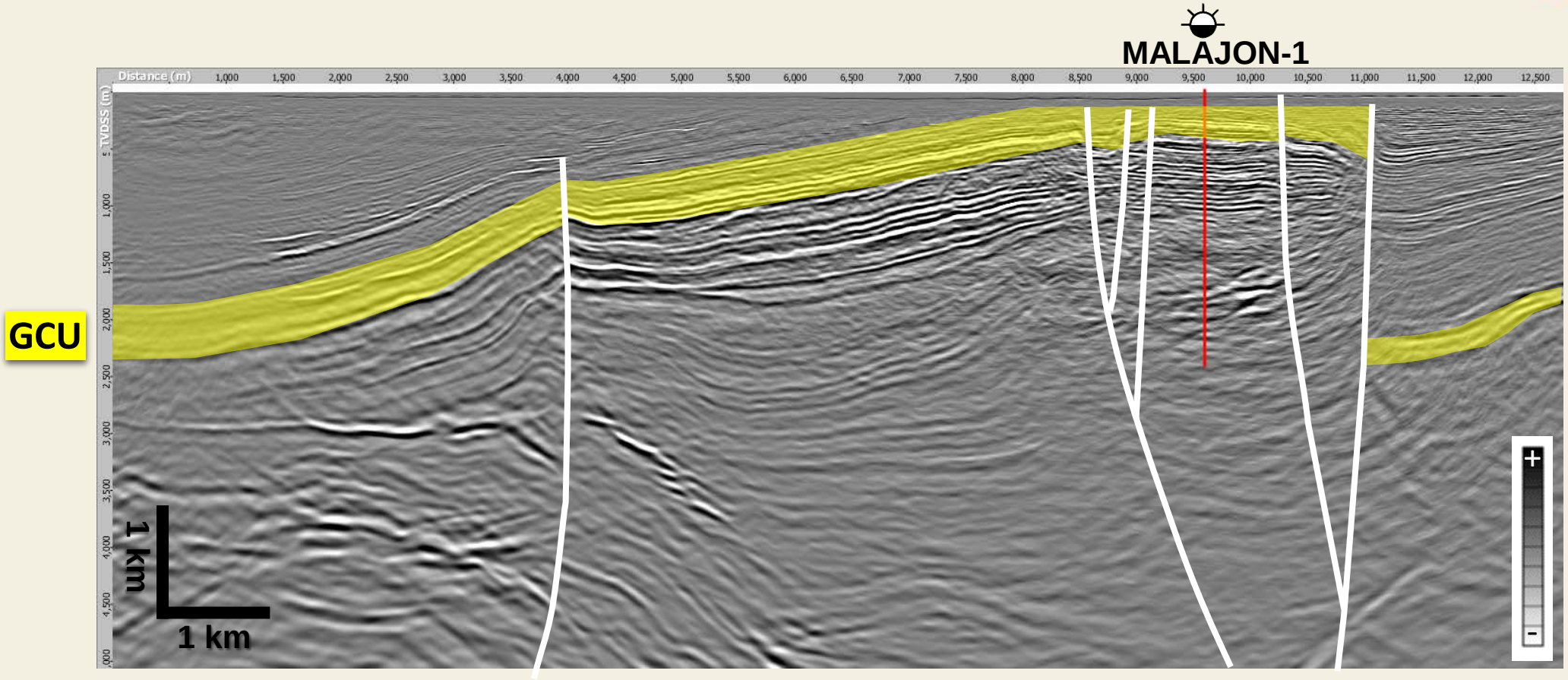

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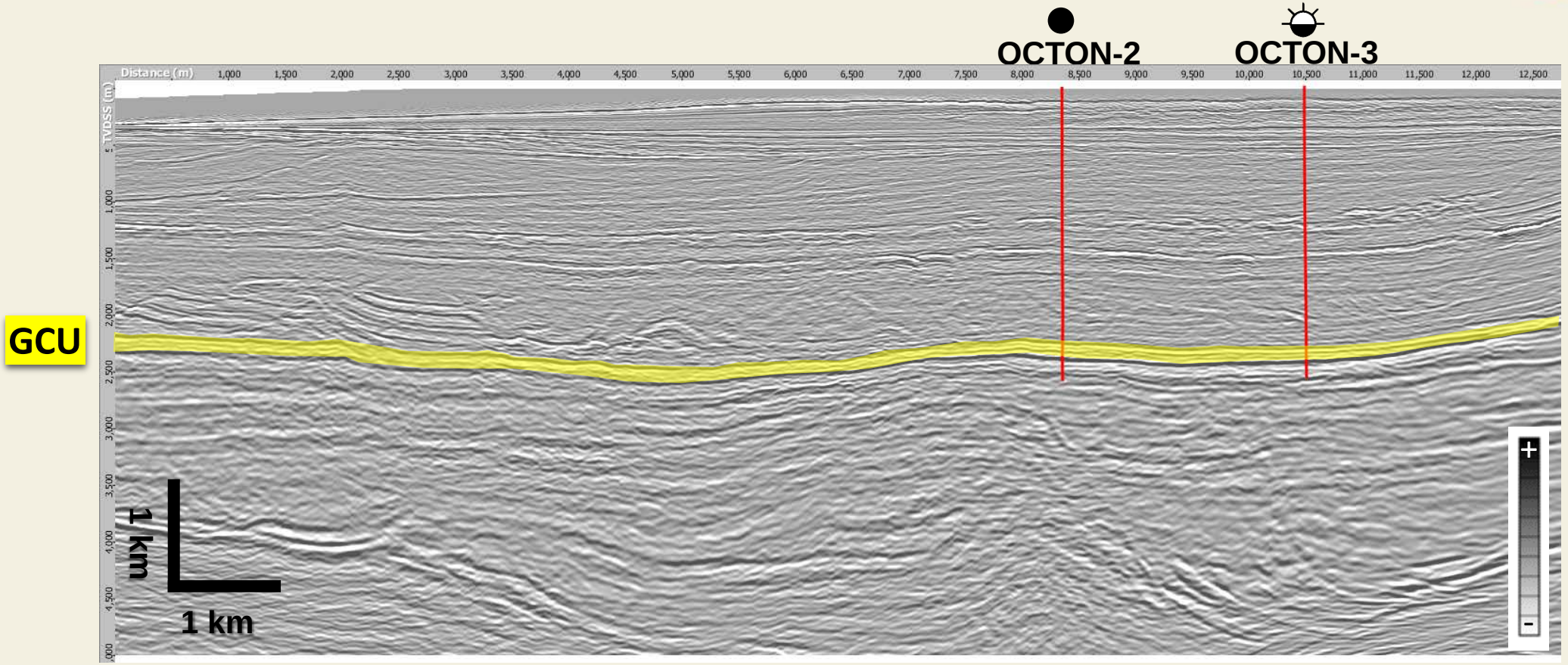

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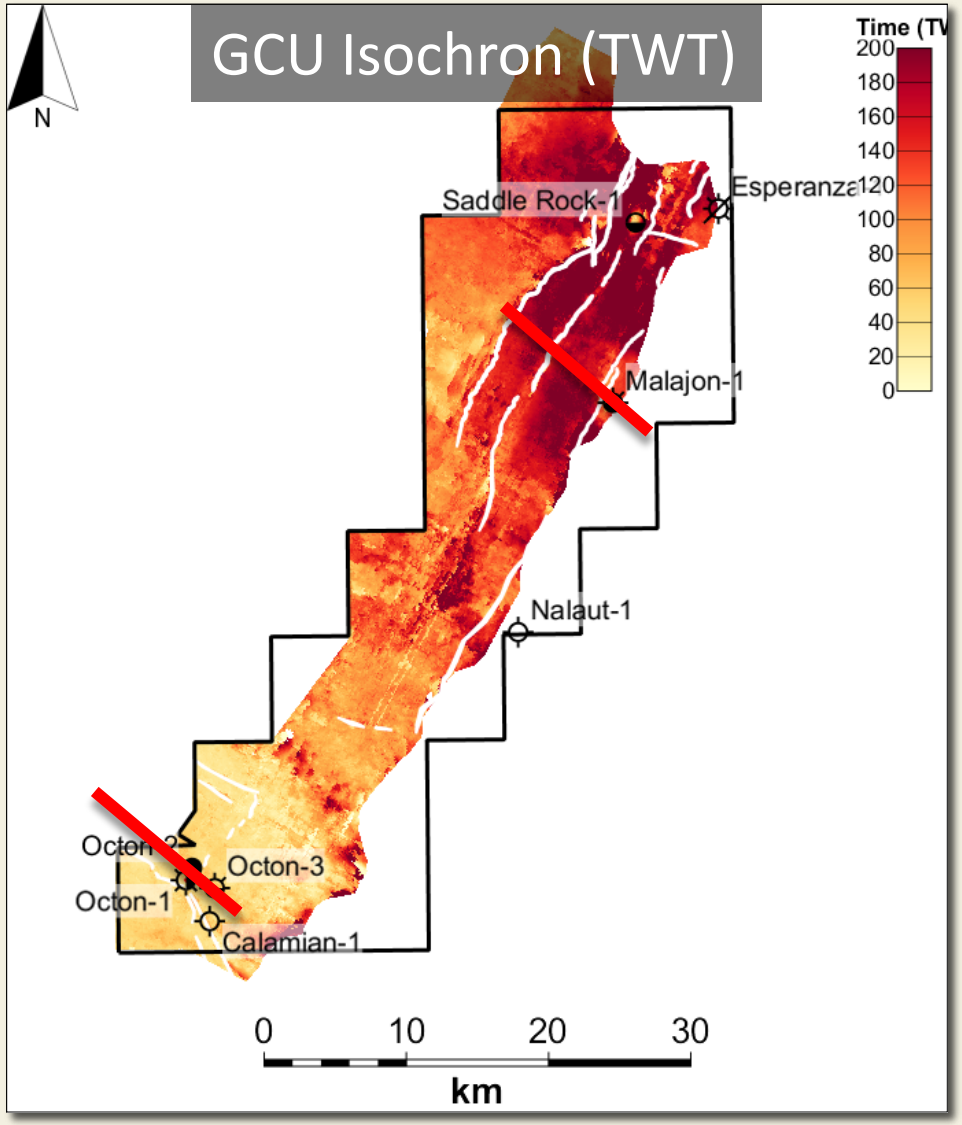
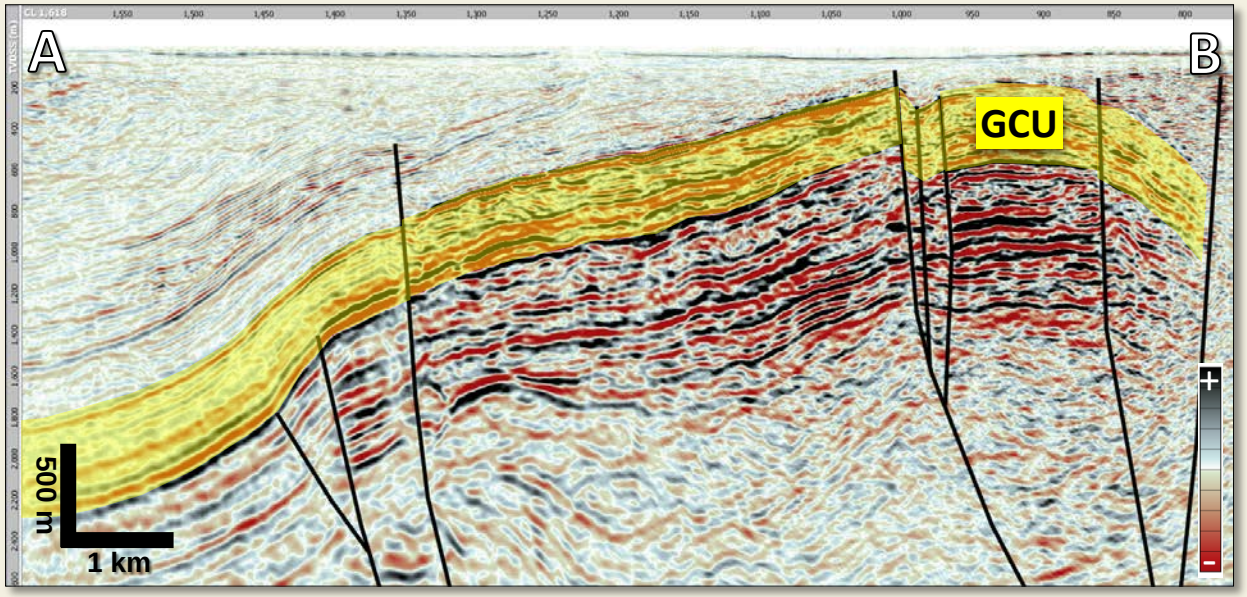
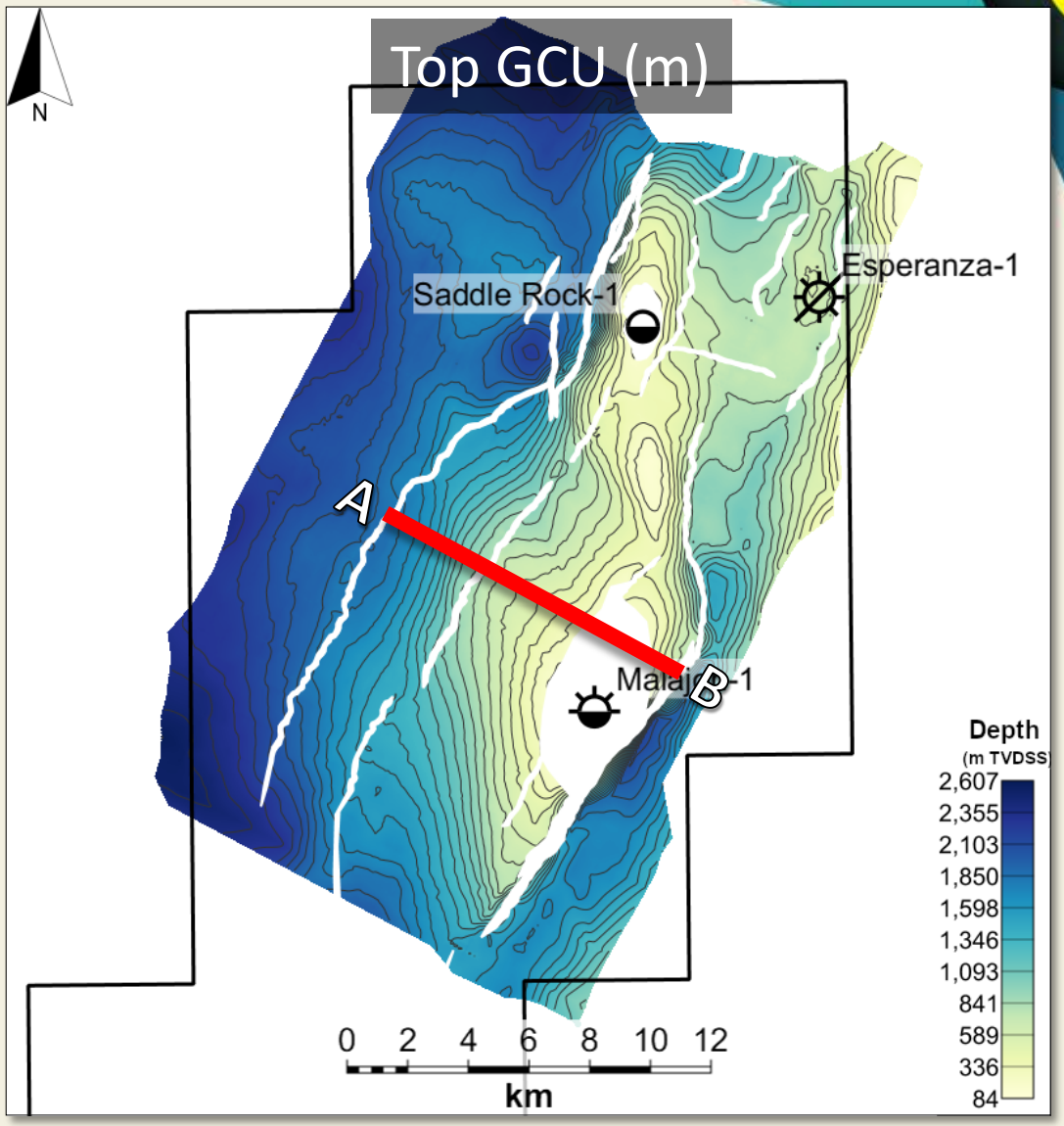


NORTH BLOCK

INSTANTANEOUS AMPLITUDES





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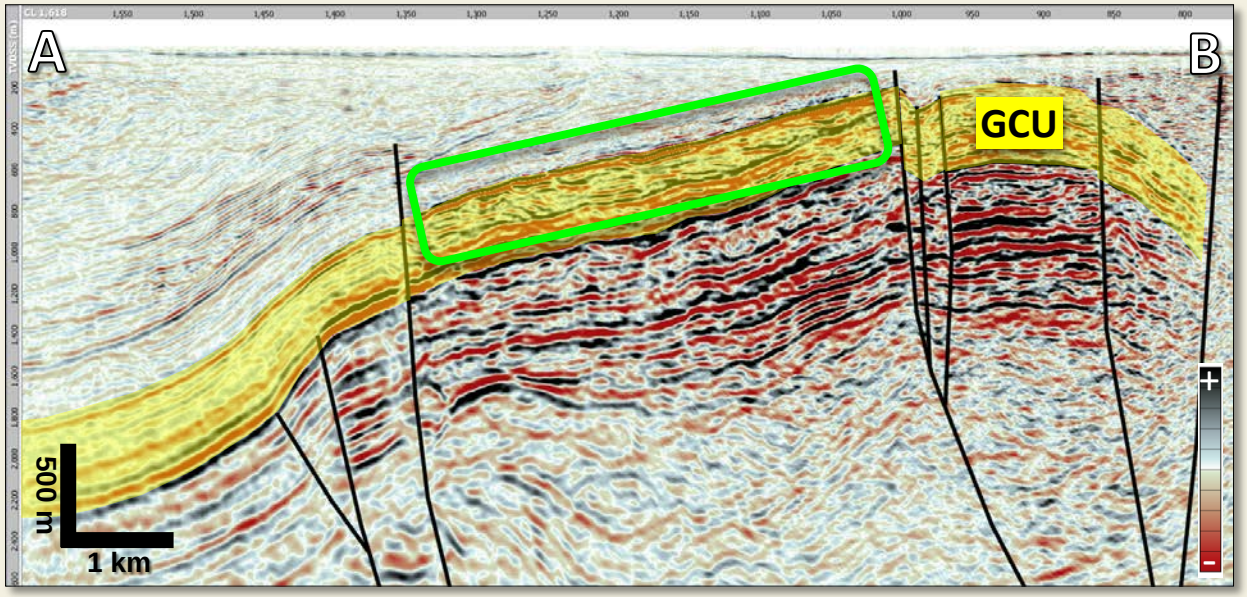

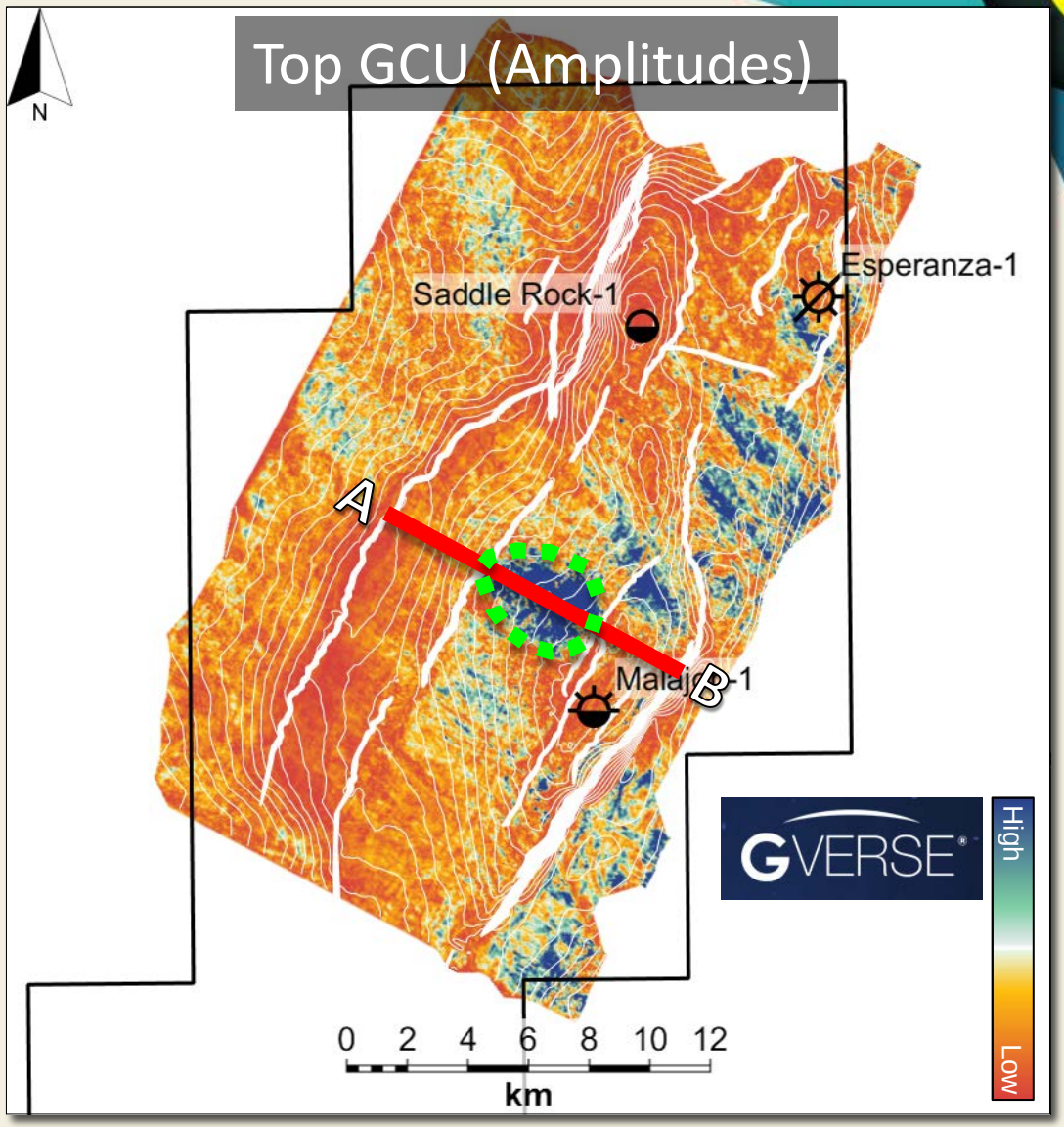

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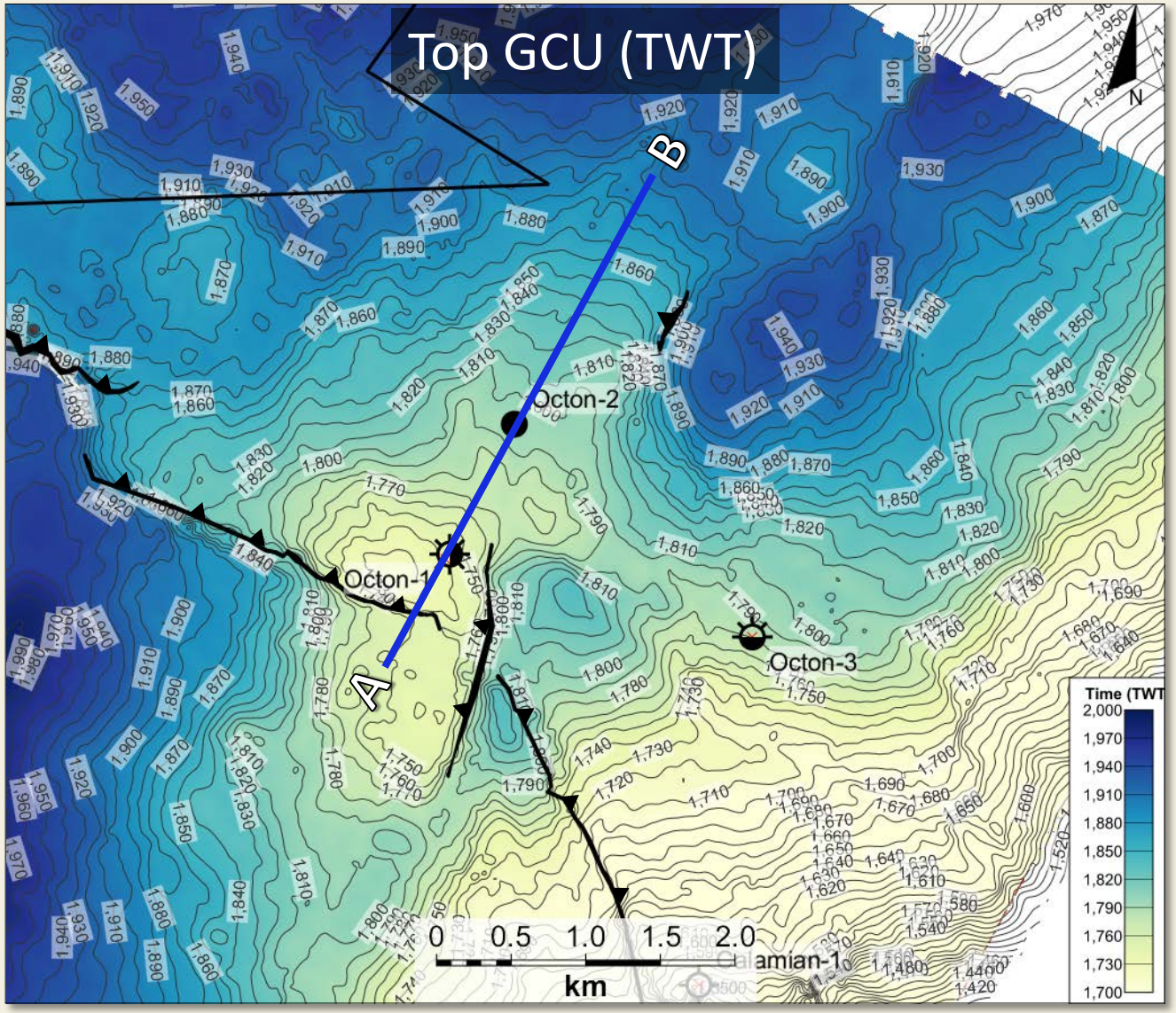

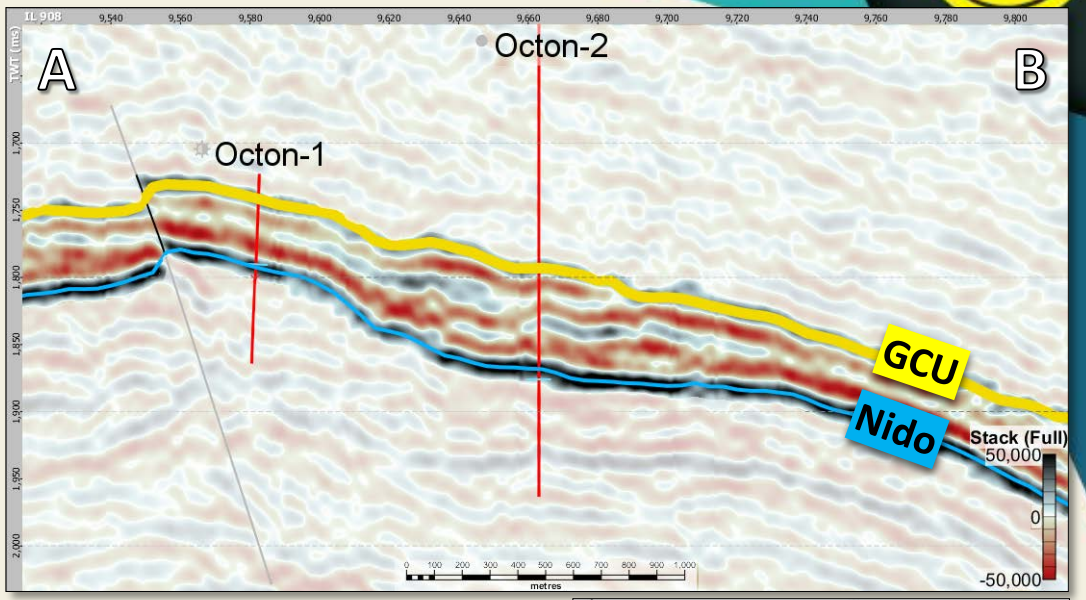

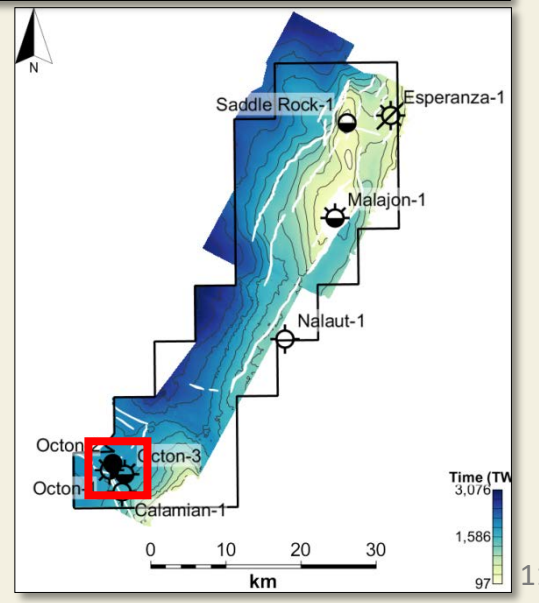

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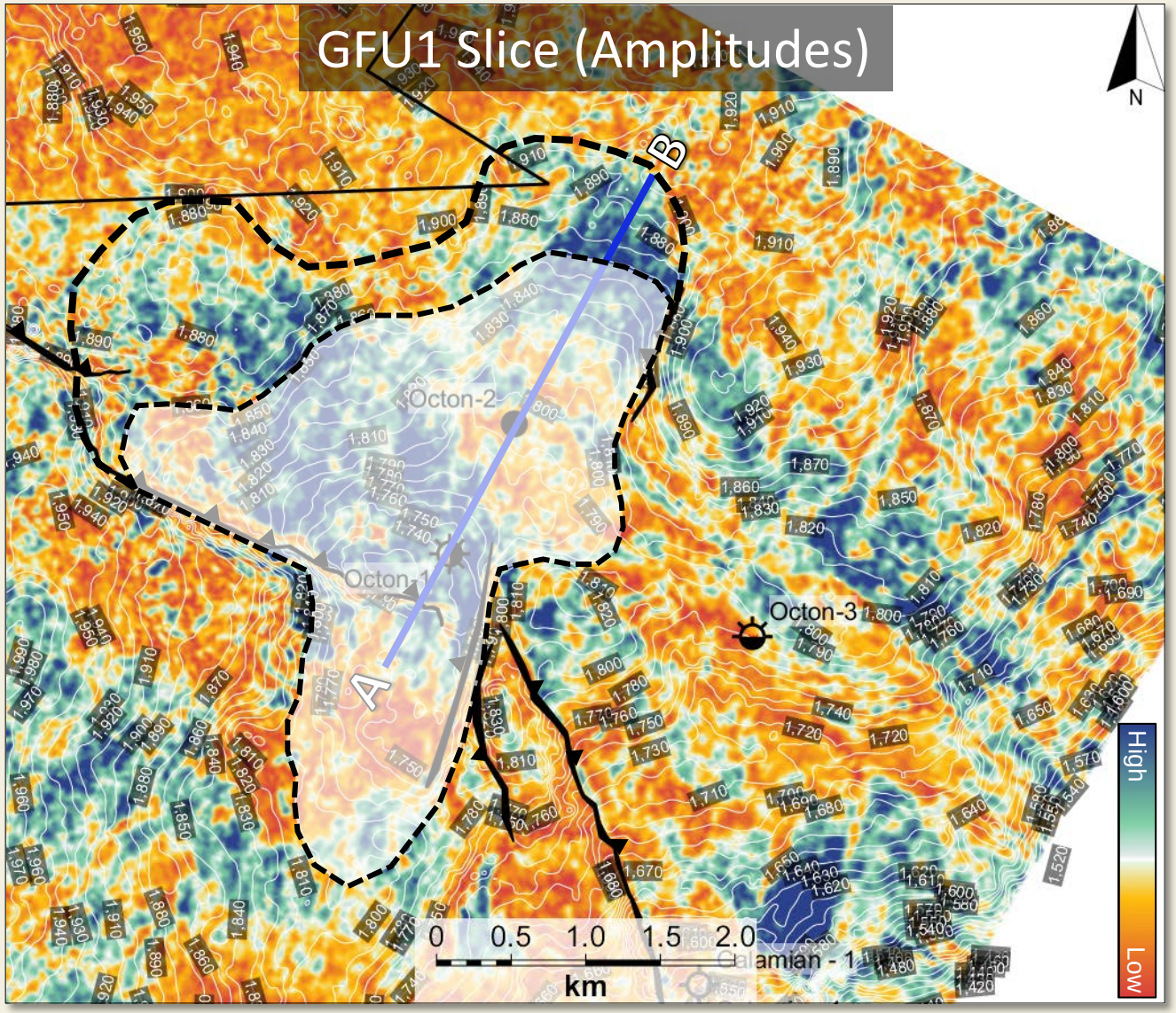
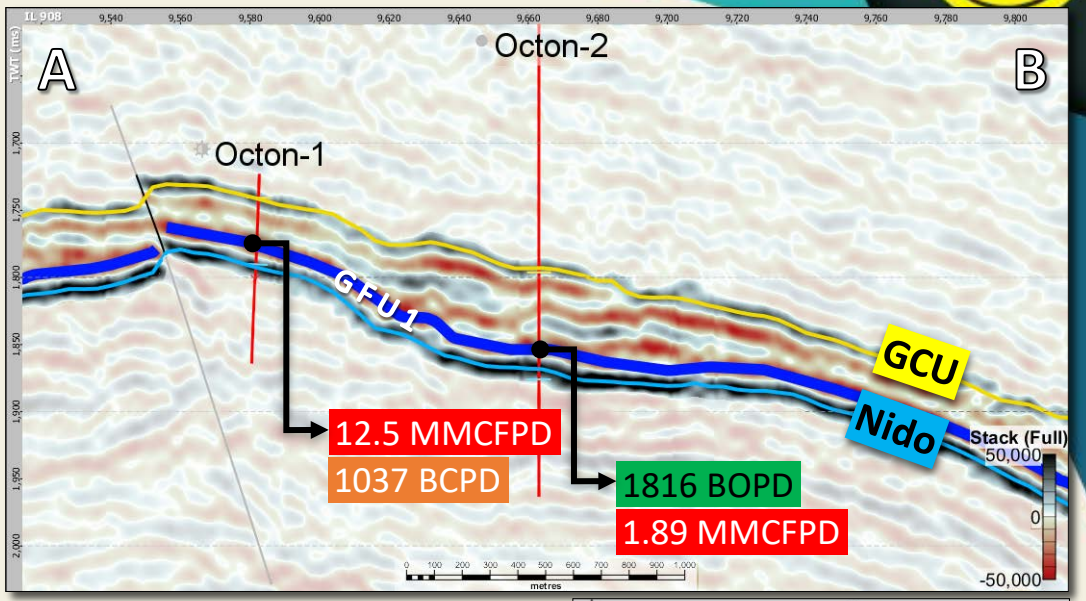
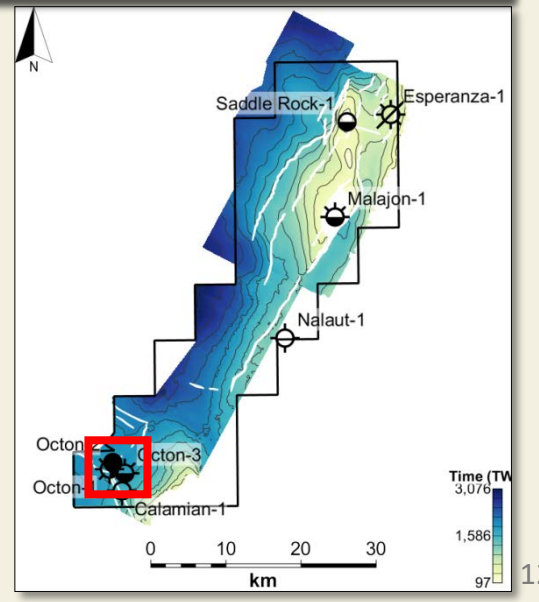
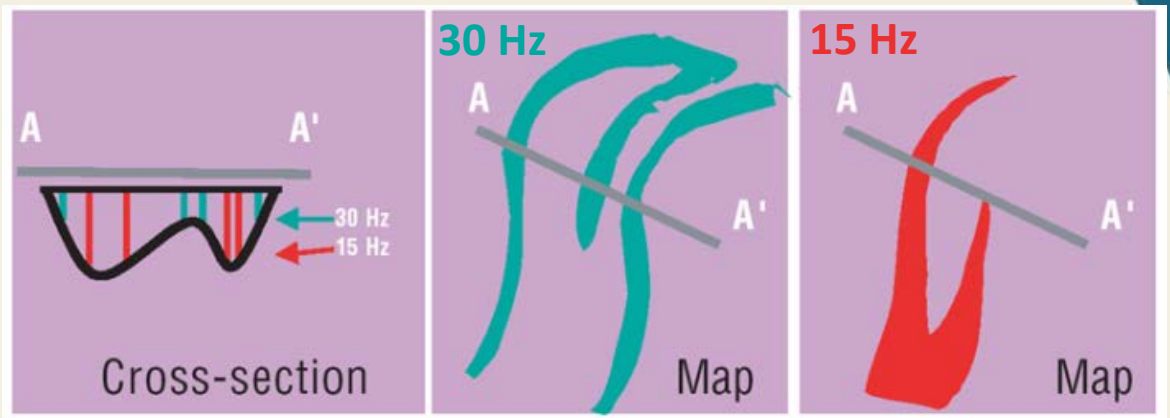






SPECTRAL DECOMPOSITION: Theory

- A reflection from a **thin bed**, has a characteristic response in the **frequency domain** that is indicative of that temporal **bed thickness** (Partyka et al, 1999).

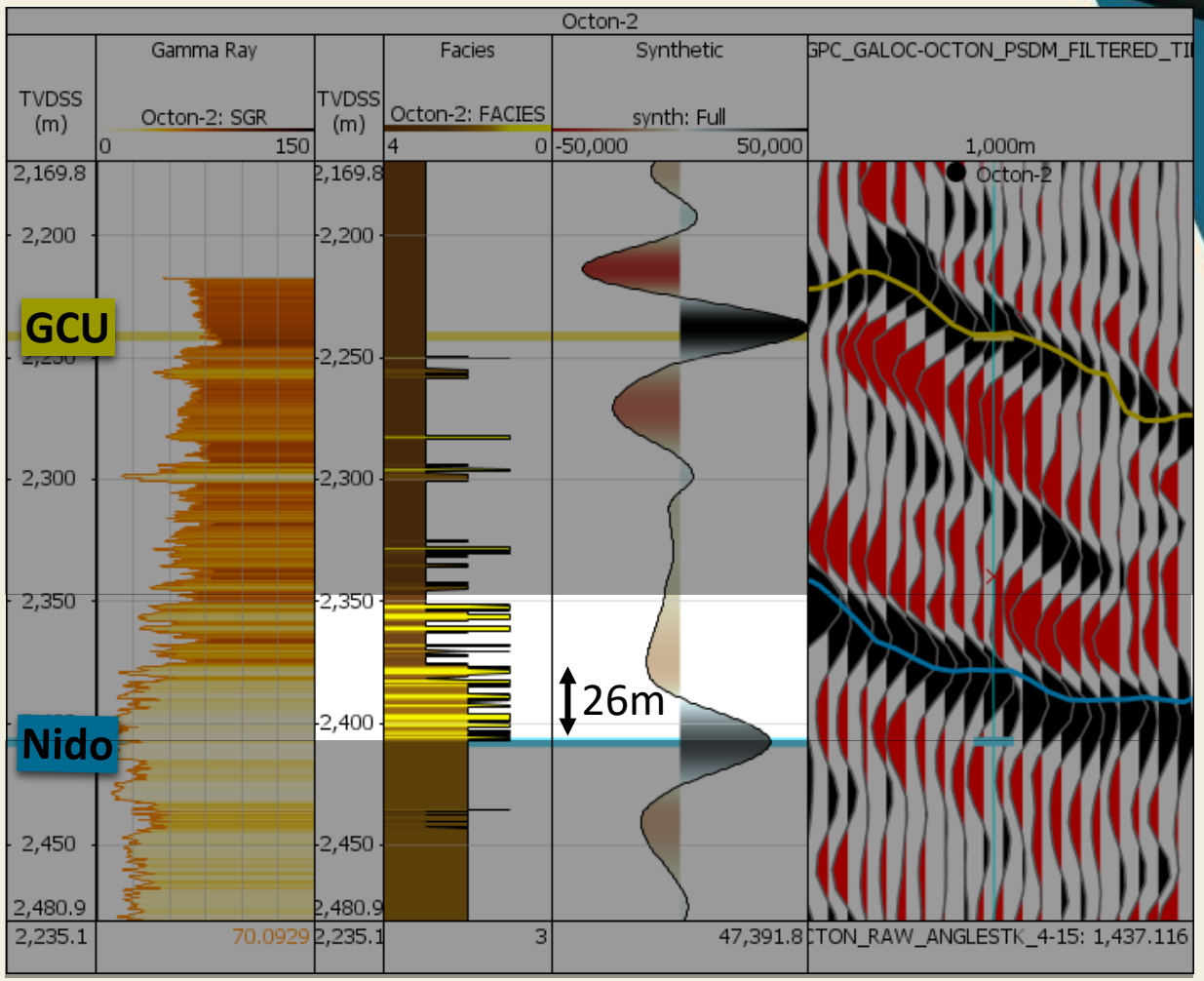


Schematic from: Laughlin et al (2003)

SPECTRAL DECOMPOSITION: Theory

- A reflection from a **thin bed**, has a characteristic response in the **frequency domain** that is indicative of that temporal **bed thickness** (Partyka et al, 1999).
  - Thin bed: Seismic resolution at the GCU level in SC 6A is ~26 m.

OCTON-2 Synthetic Seismogram



SPECTRAL DECOMPOSITION: Theory

- A reflection from a **thin bed**, has a characteristic response in the **frequency domain** that is indicative of that temporal **bed thickness** (Partyka et al, 1999).
    - Thin bed: Seismic resolution at the GCU level in SC 6A is ~26 m.
- Spectral decomposition utilizes the **Fourier Transform** to breakdown the waveform.
    - Premise: a waveform is a composite expression of multiple sinusoids attuned to different frequencies.

FOURIER TRANSFORM

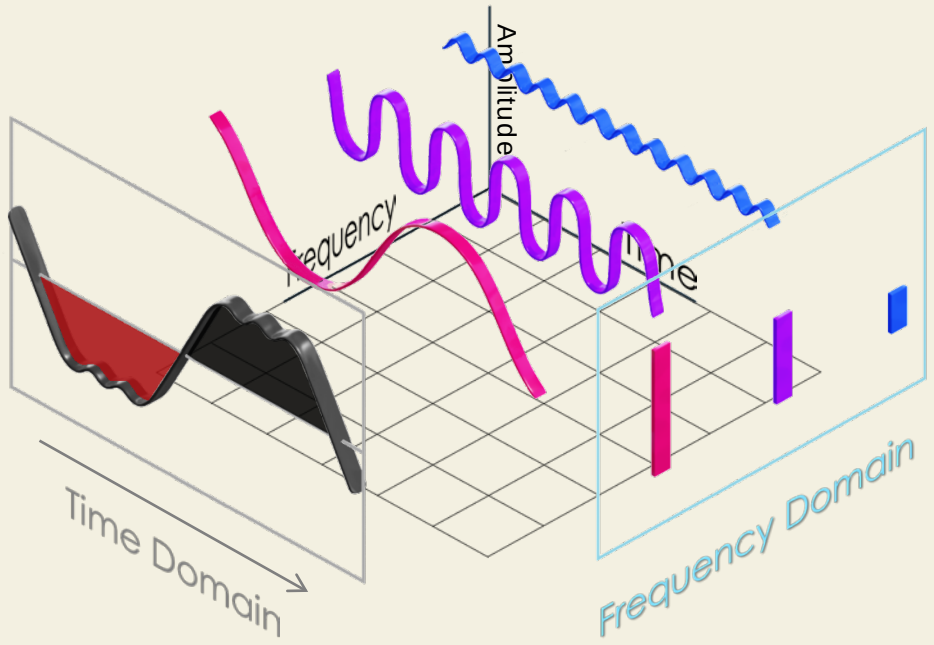


Diagram from ifm.com/en/us

SPECTRAL DECOMPOSITION: Case Study

- Pioneering work done by AMOCO
- Pennsylvanian Red Fork Sandstone, Onshore Anadarko basin, USA

Peyton, Bottjier, Partyka (1998)

Interpretation of incised valleys using new 3-D seismic techniques: A case history using spectral decomposition and coherency

Partyka, Gridley, Lopez (1999)

Interpretational applications of spectral decomposition in reservoir characterization

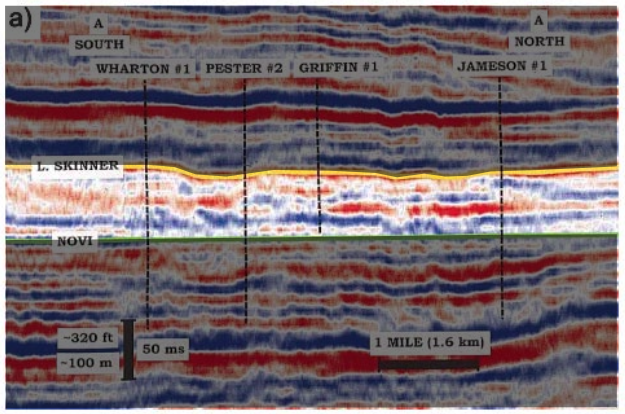


Figure 2. Seismic cross-section A flattened on Novi horizon; (a) without and (b) with current interpretation.

Peyton et al (1998).

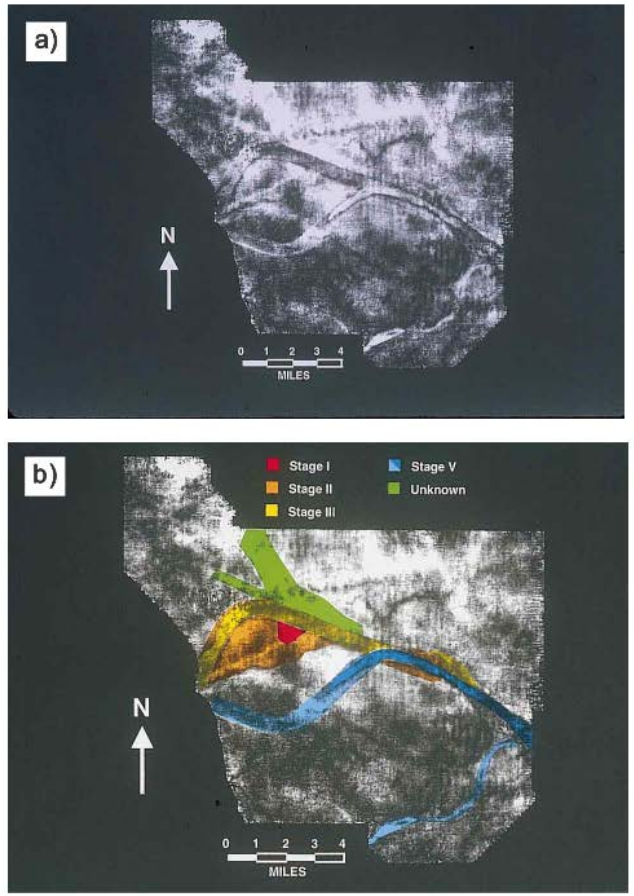
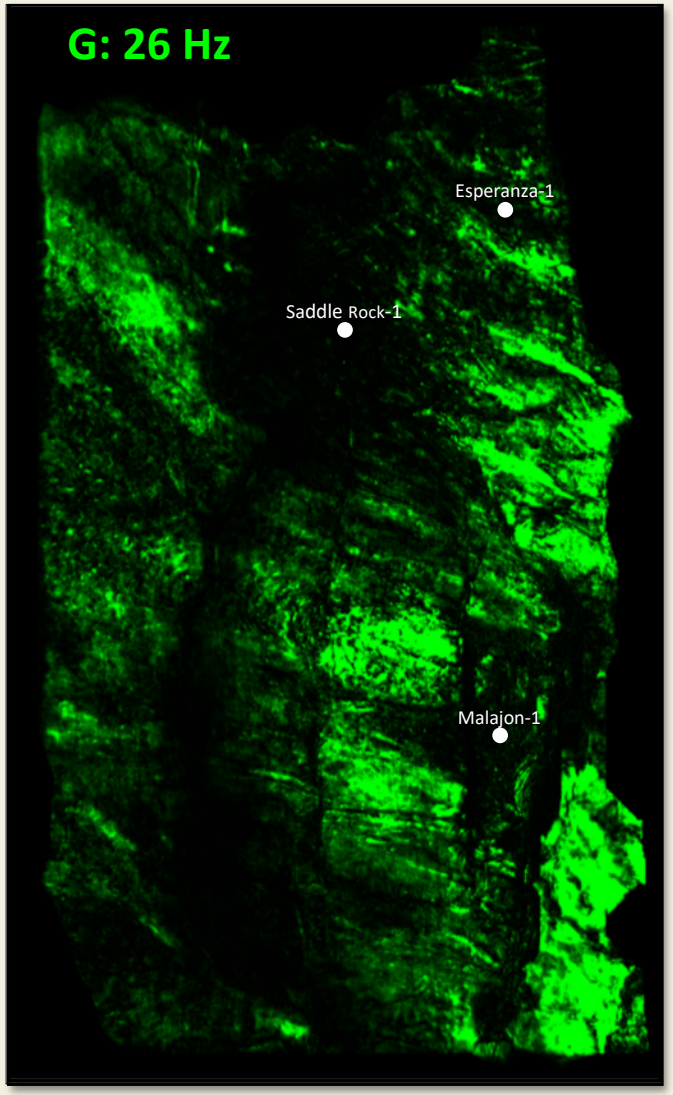
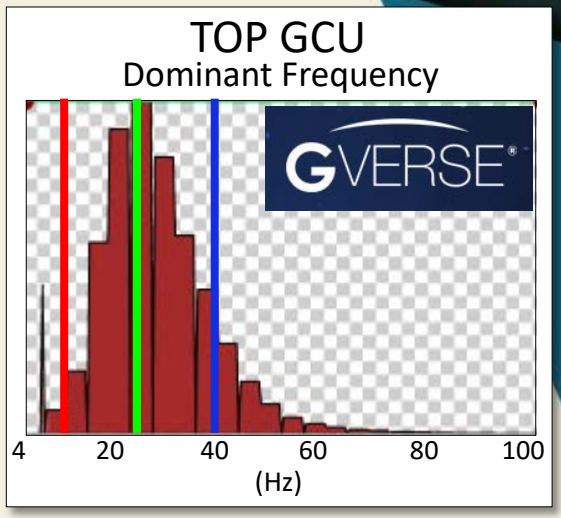
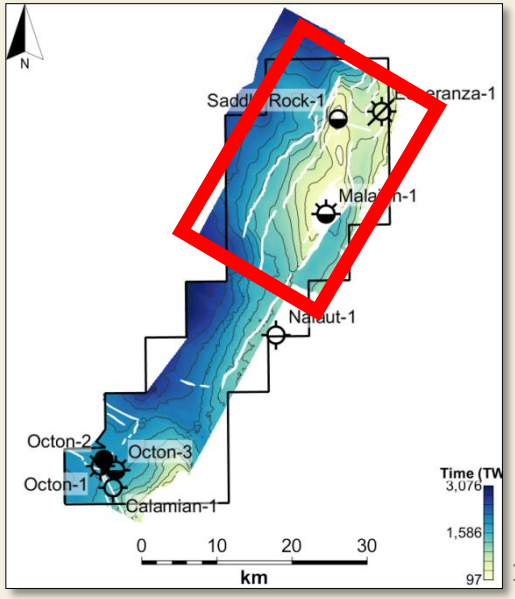


Figure 3. 36-Hz amplitude slice from Red Fork spectral decomposition; (a) without and (b) with current interpretation.

SPECTRAL DECOMPOSITION
NORTH BLOCK







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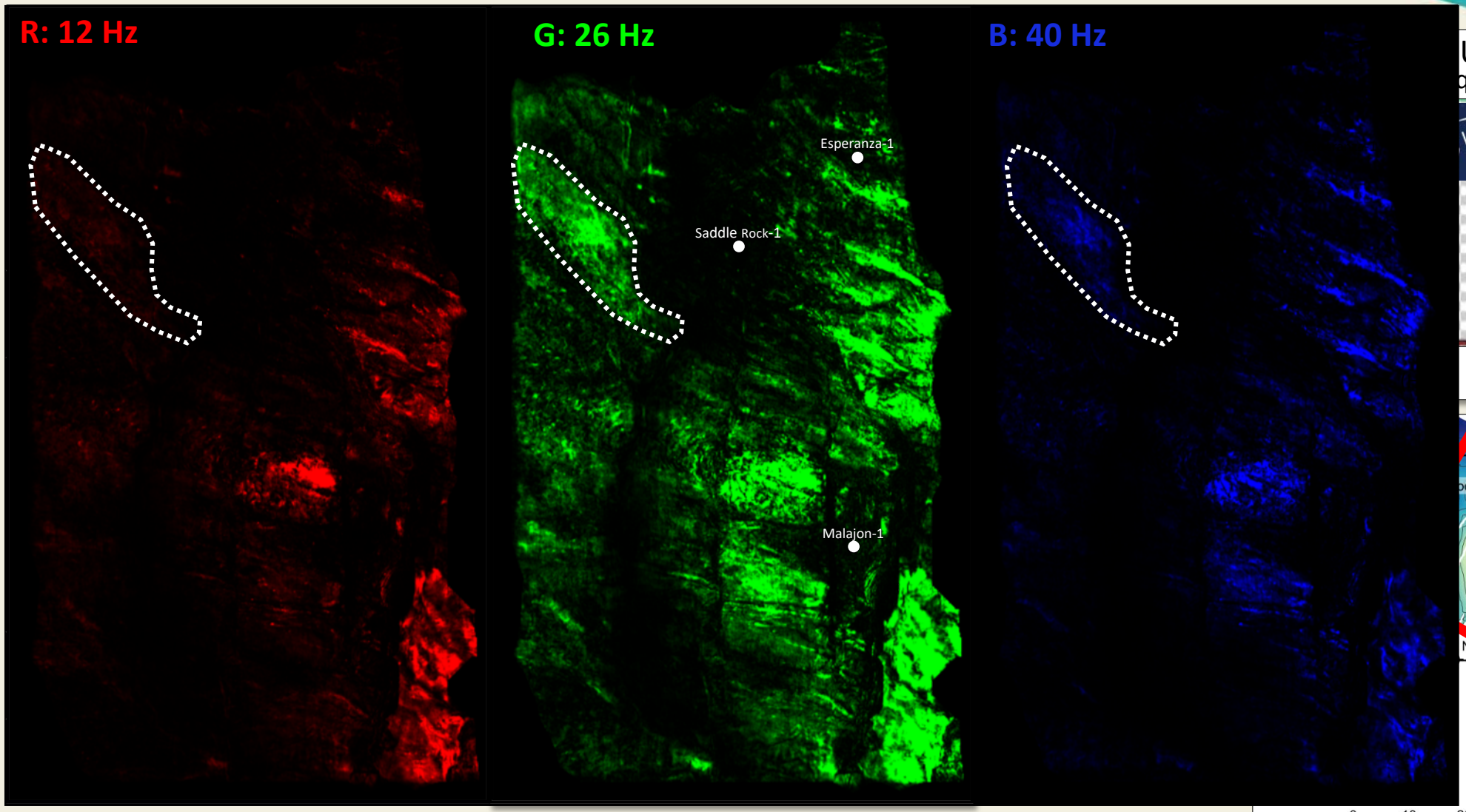

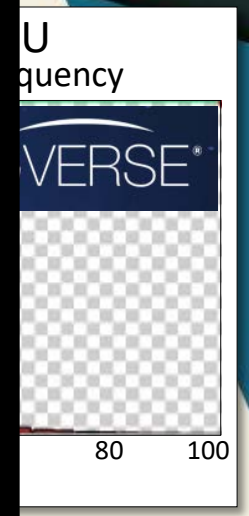

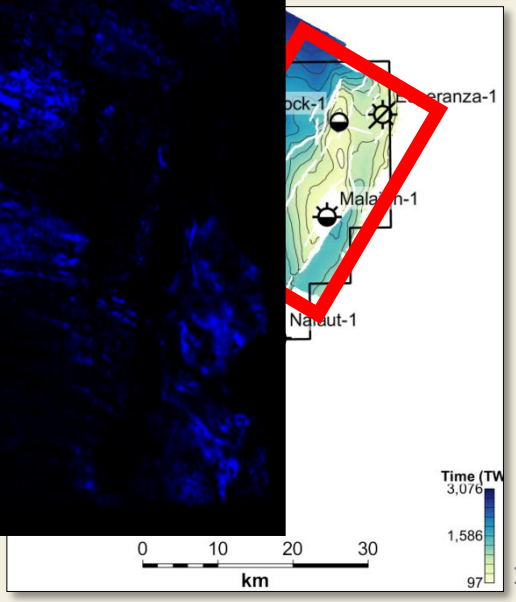

SPECTRAL DECOMPOSITION
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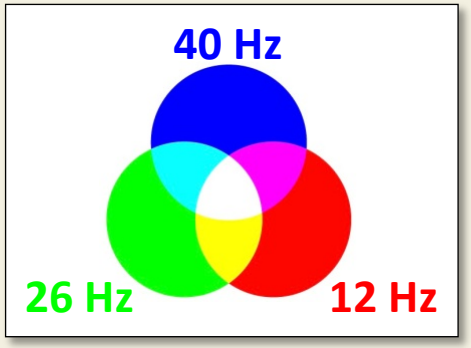

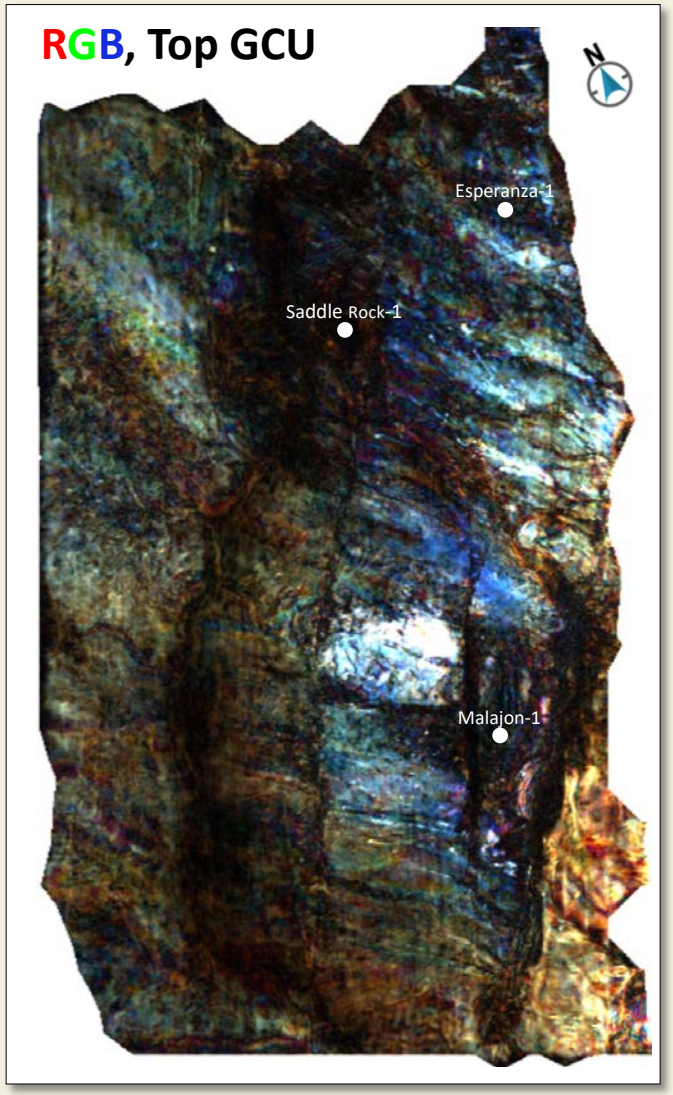

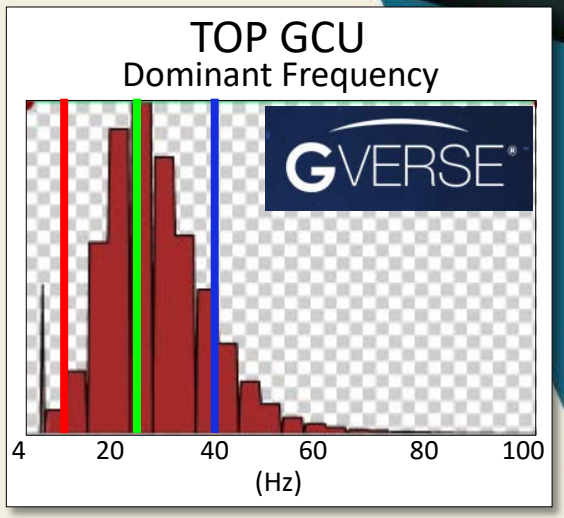

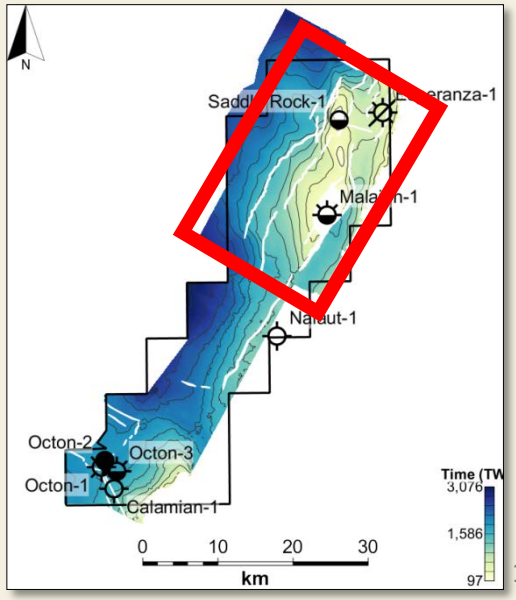

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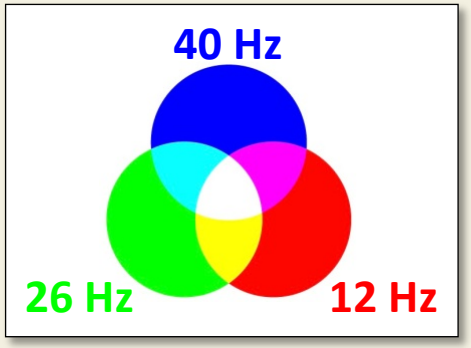
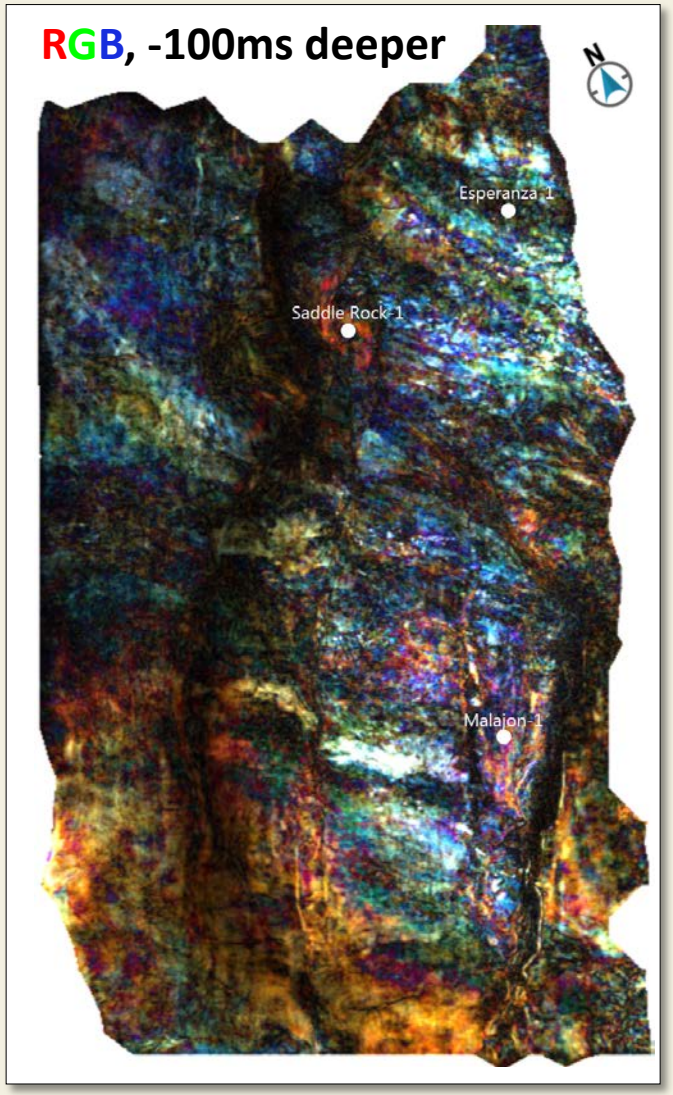
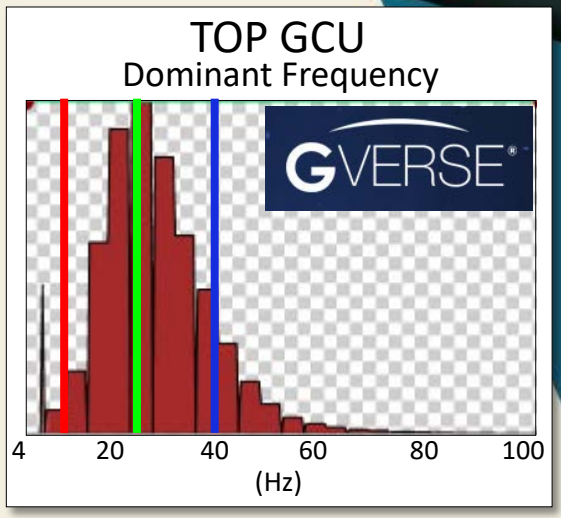
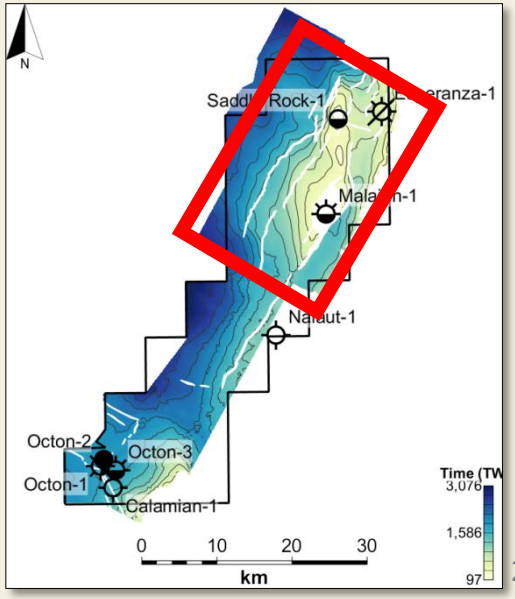


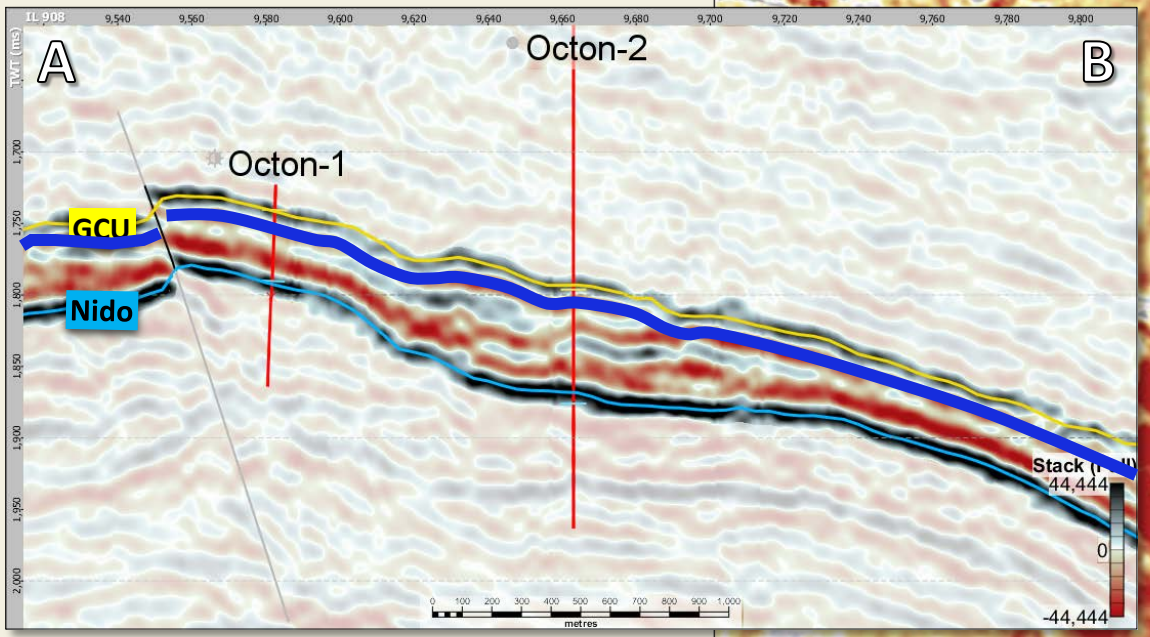


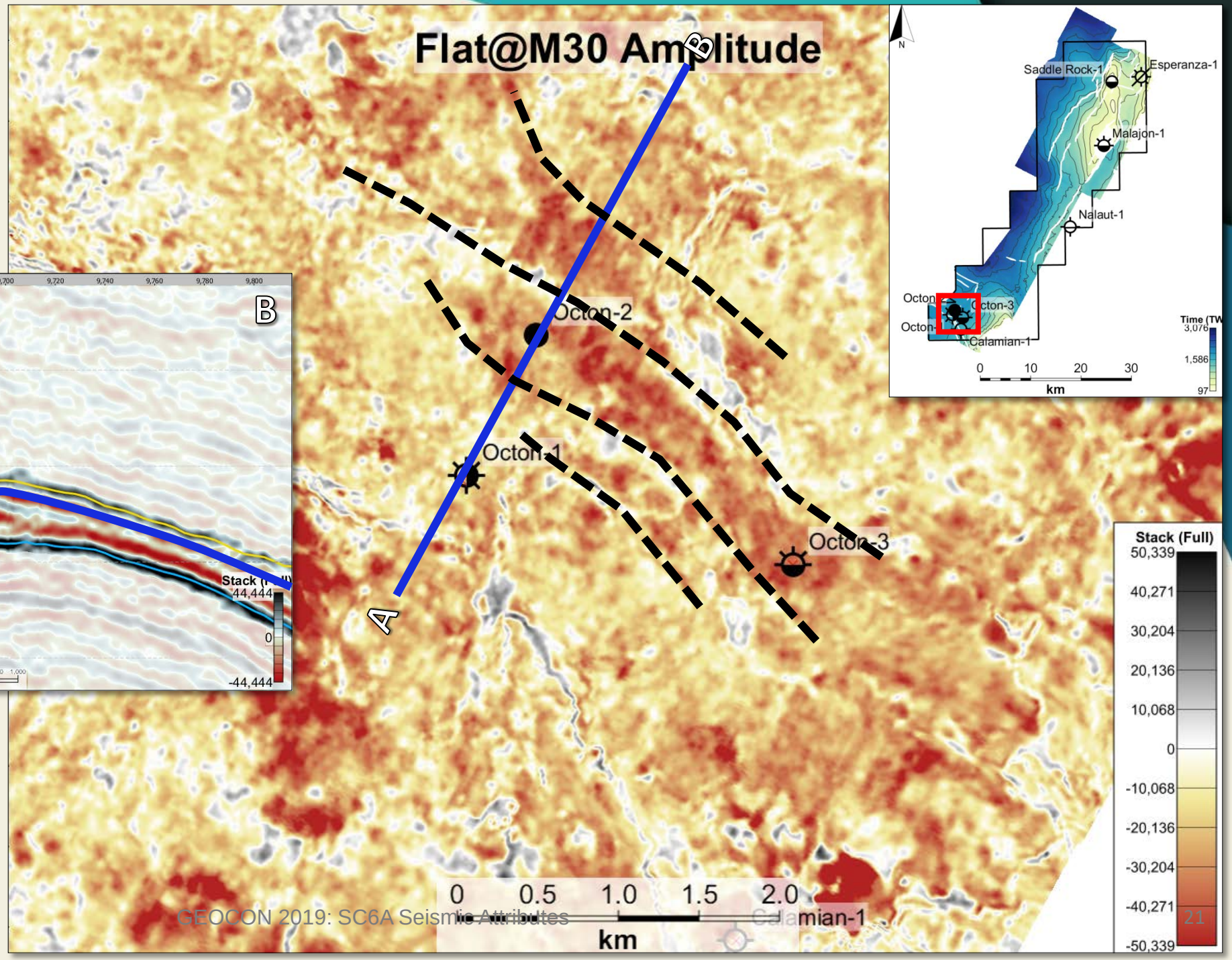




SPECTRAL DECOMPOSITION

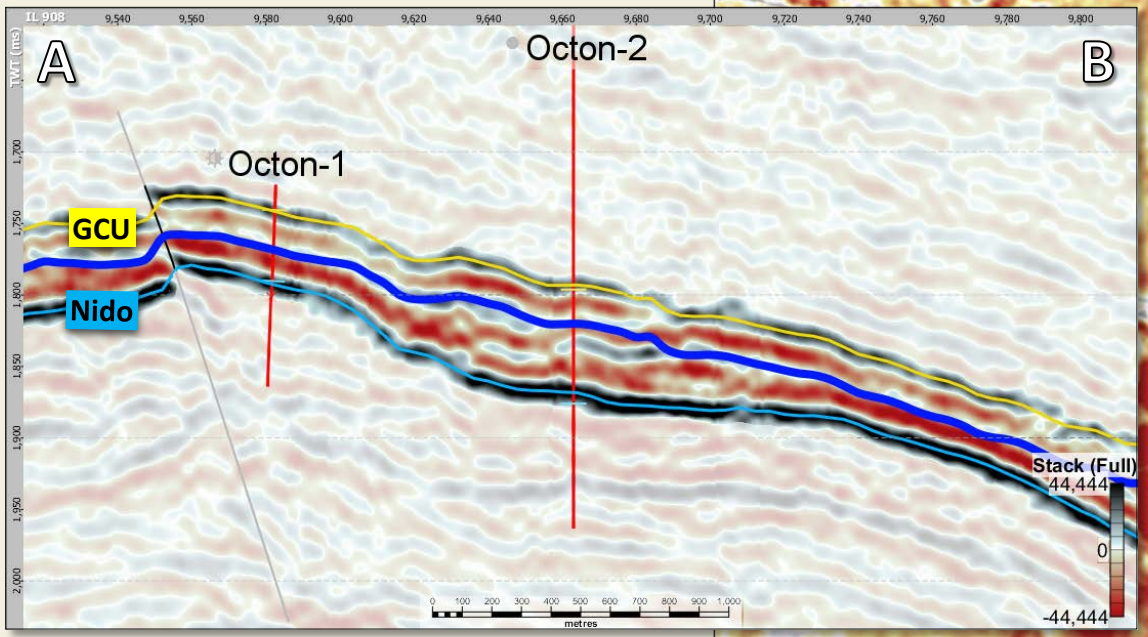
SOUTH BLOCK

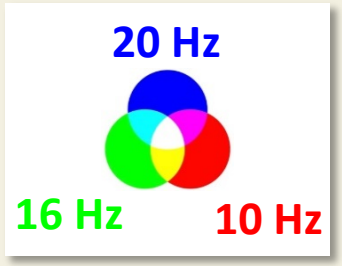


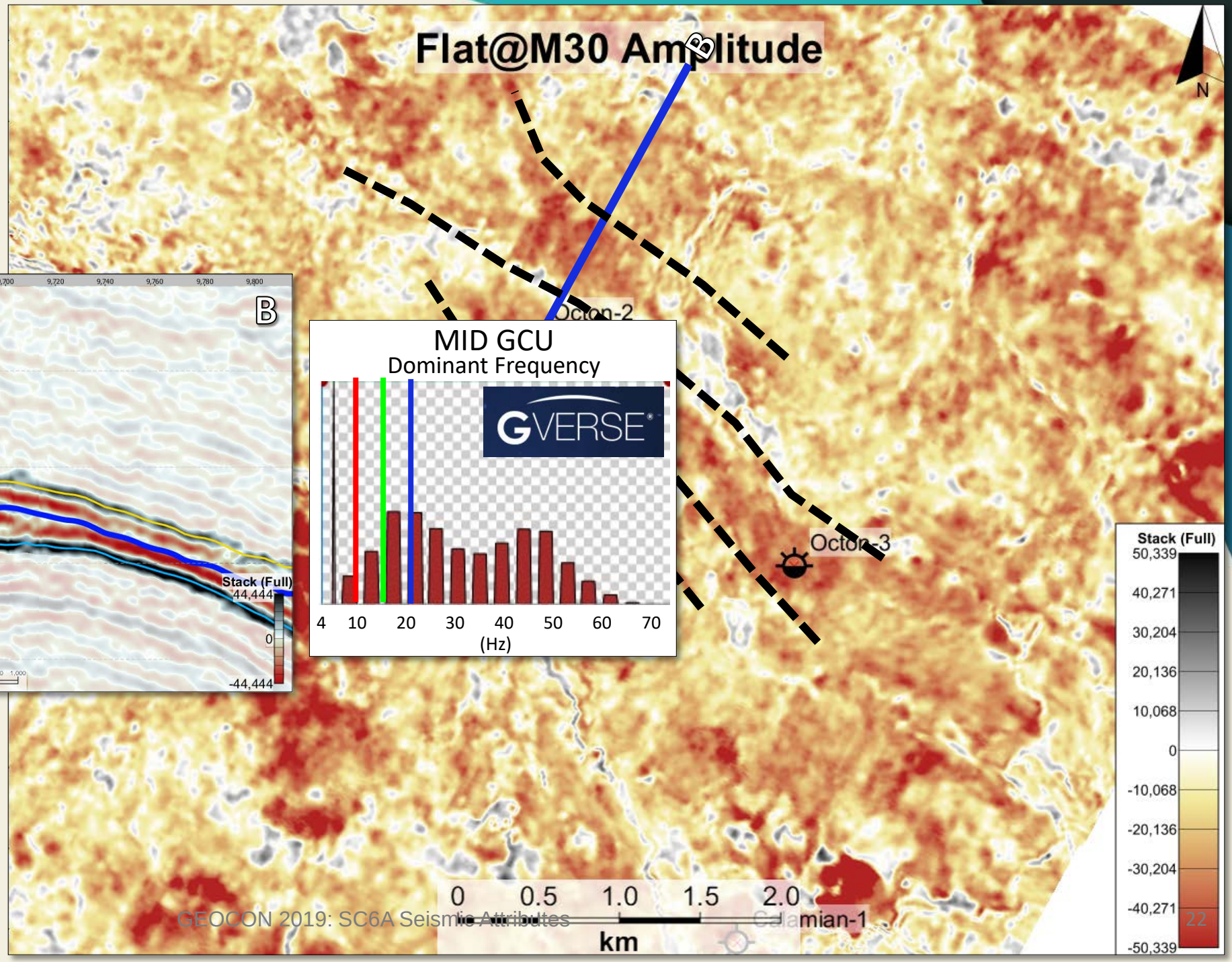


SPECTRAL DECOMPOSITION

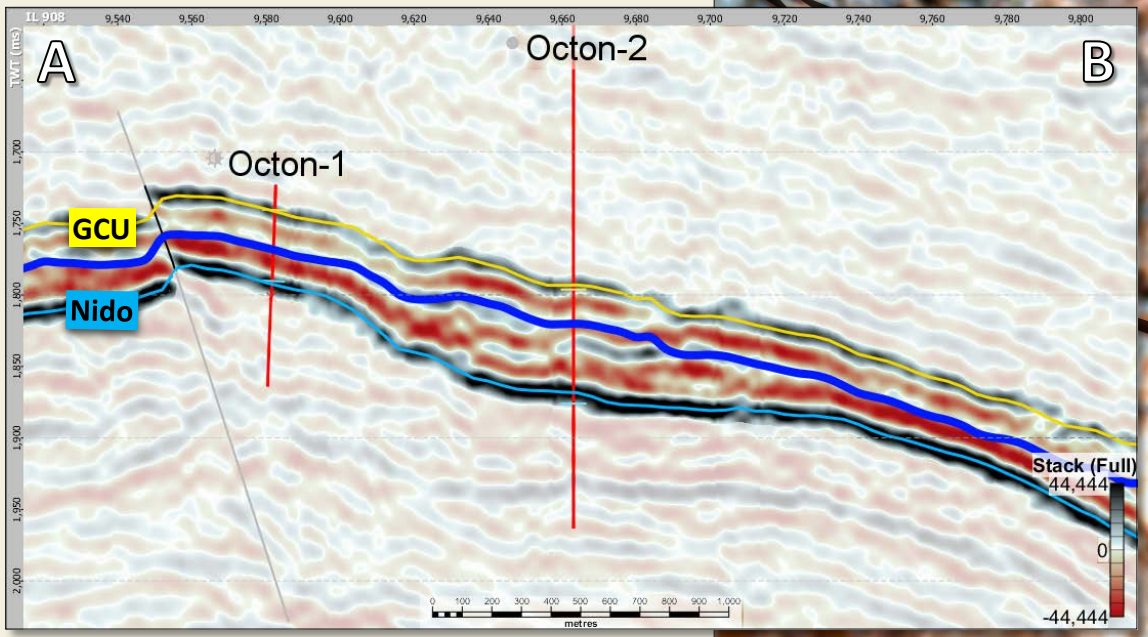
SOUTH BLOCK

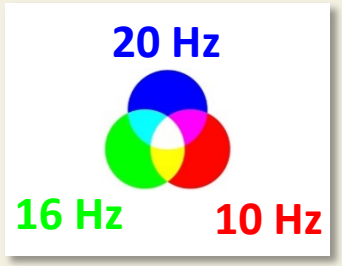


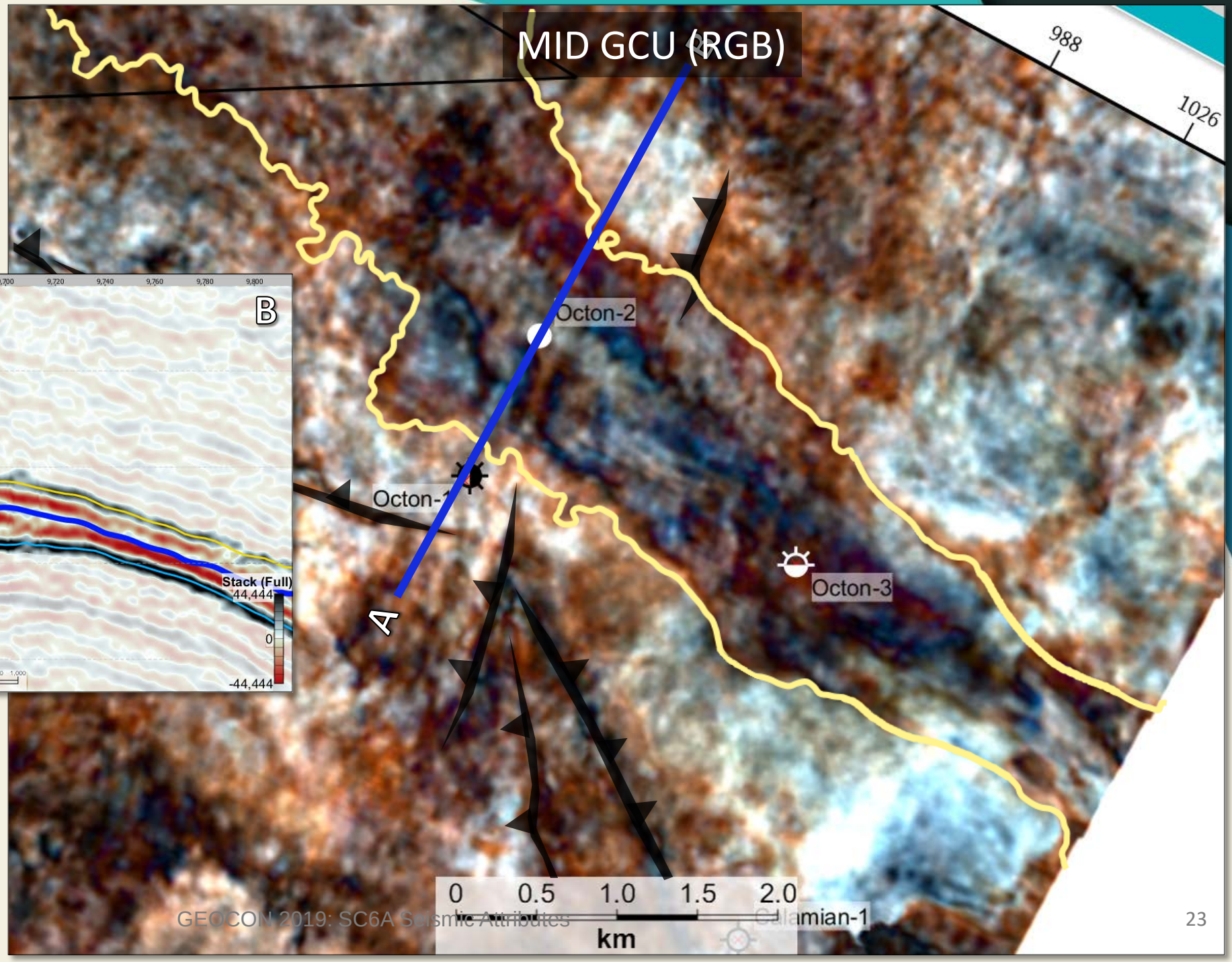




SPECTRAL DECOMPOSITION
SOUTH BLOCK

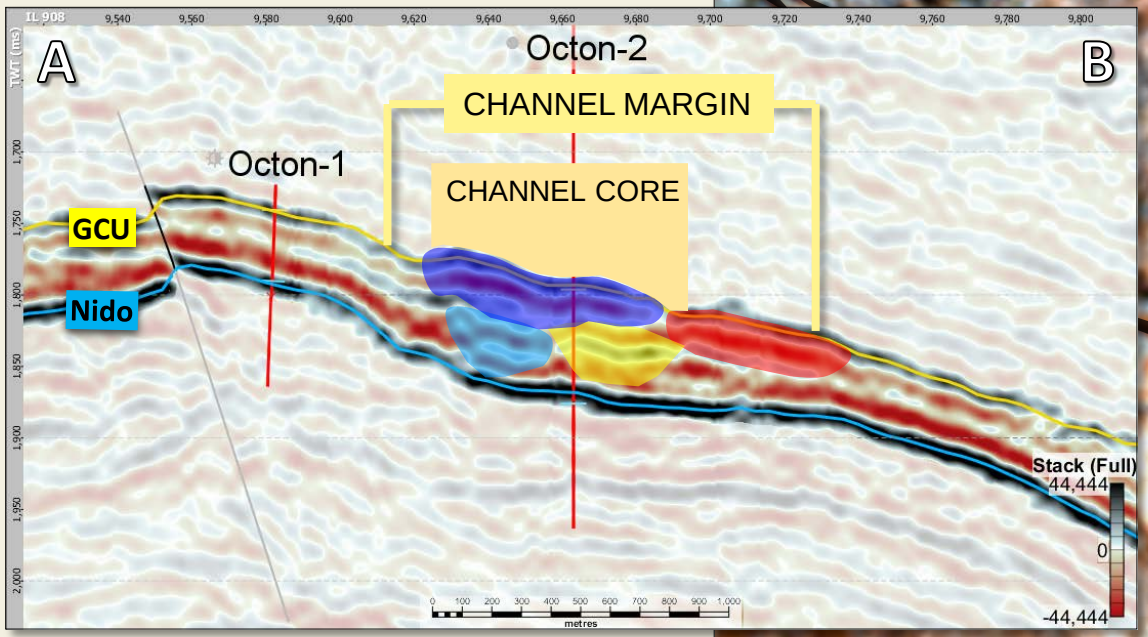


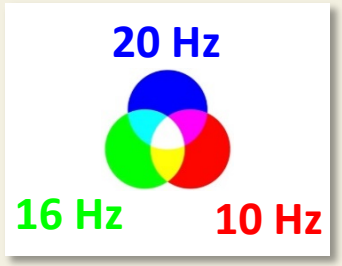




SPECTRAL DECOMPOSITION

SOUTH BLOCK





MID GCU (RGB)

988

1026

Octon-2

Octon-1

Octon-3

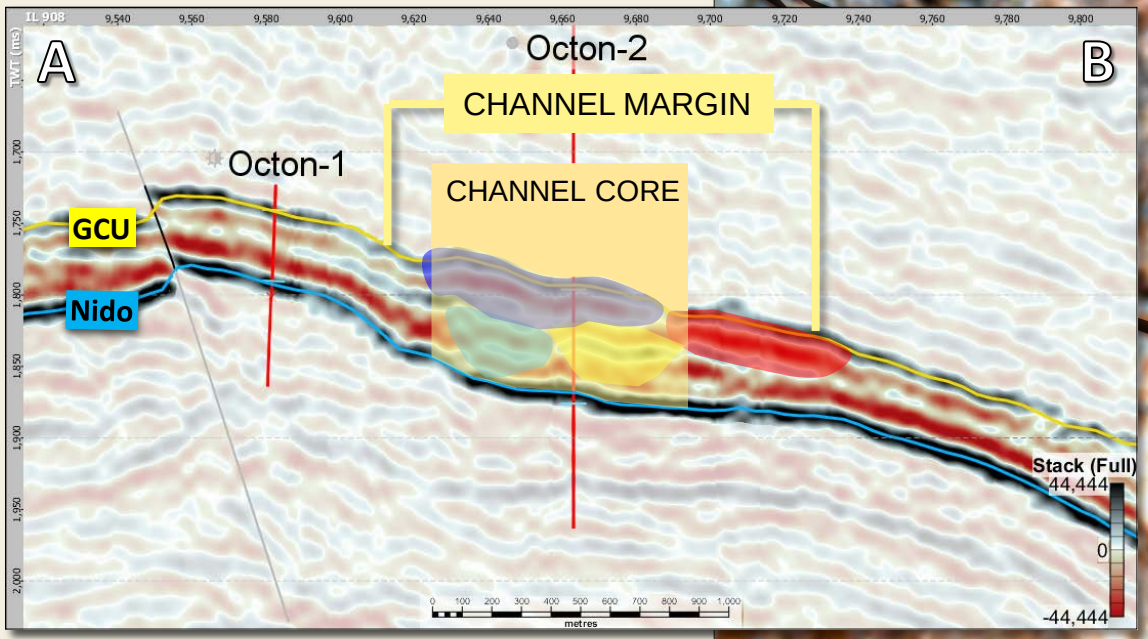
A

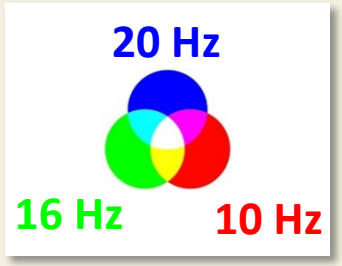
0 0.5 1.0 1.5 2.0

km

SPECTRAL DECOMPOSITION

SOUTH BLOCK





MID GCU (RGB)

988

1026

A

Octon-3

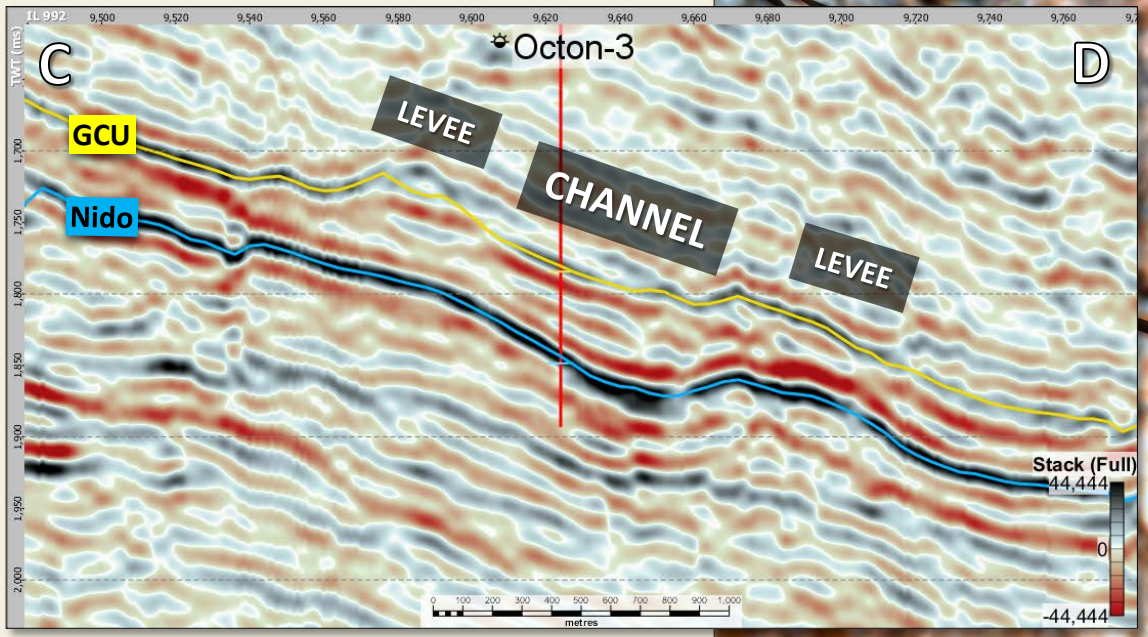
Channel Core

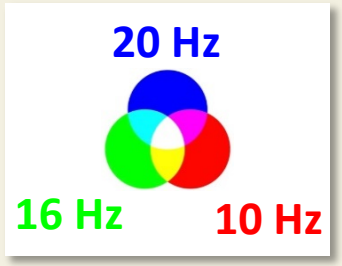
0 0.5 1.0 1.5 2.0

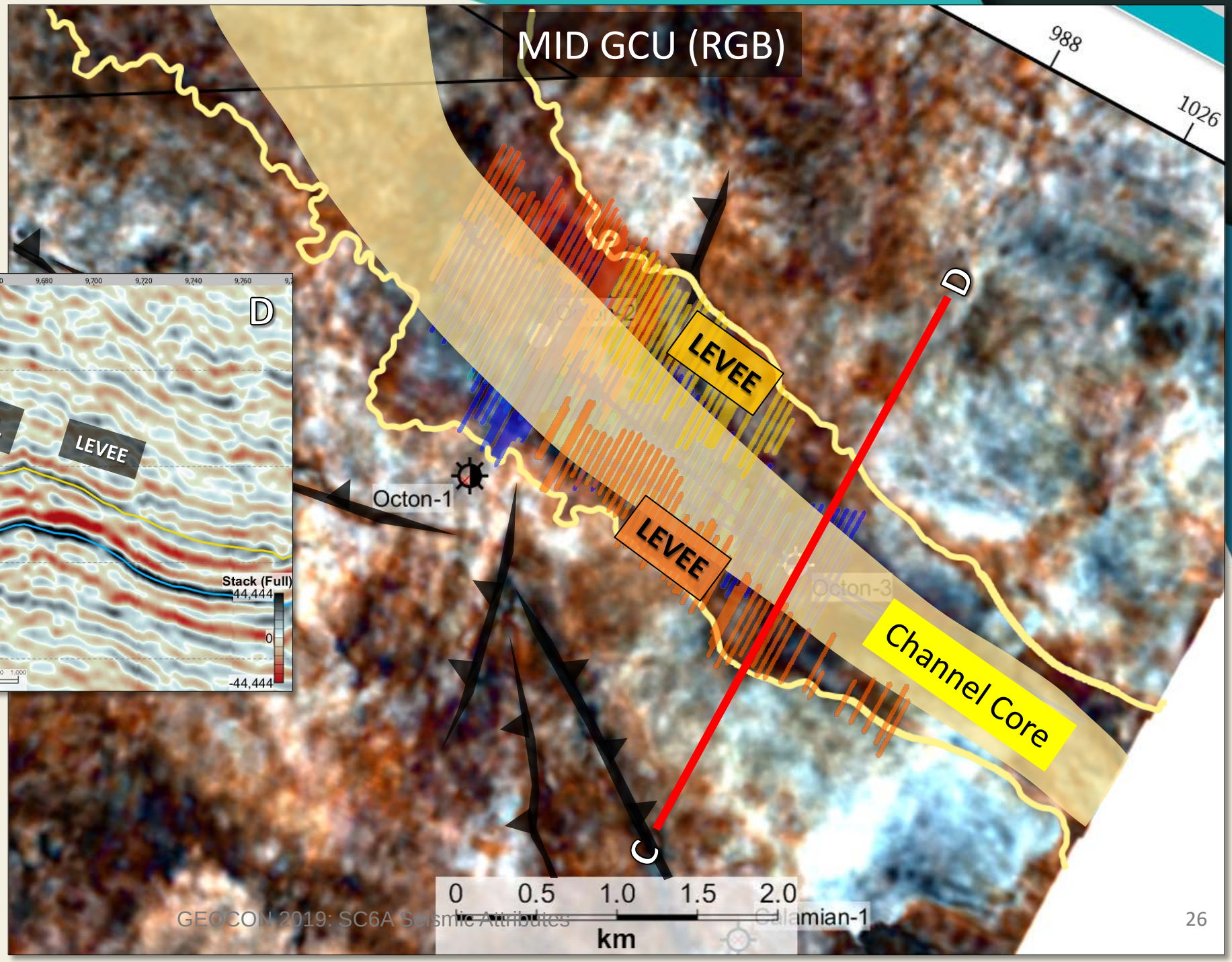
km

SPECTRAL DECOMPOSITION

SOUTH BLOCK







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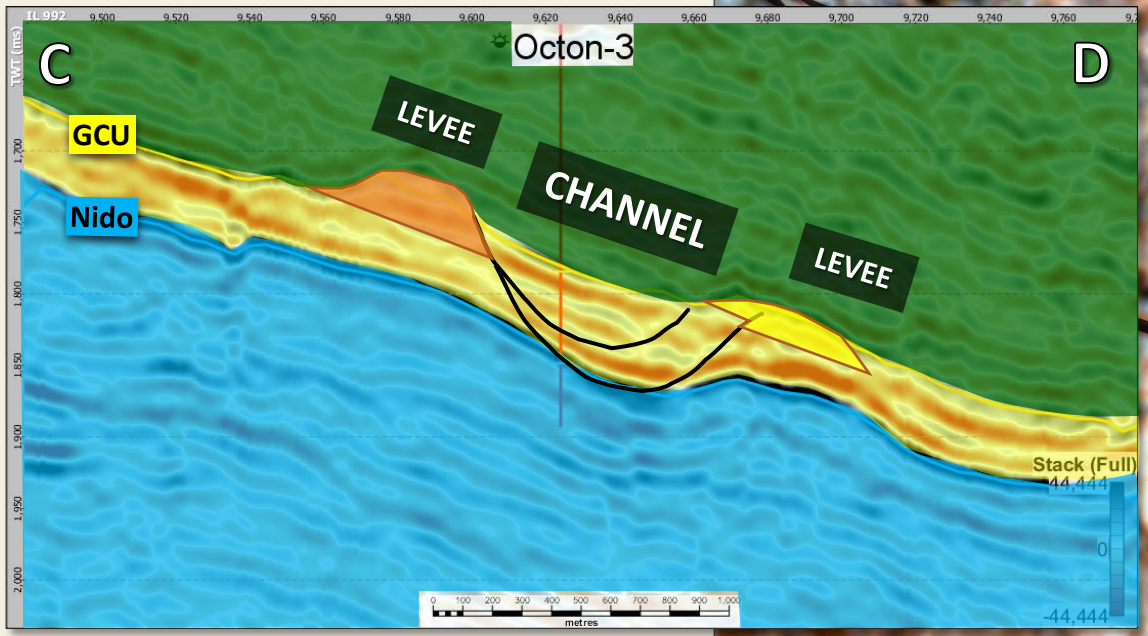
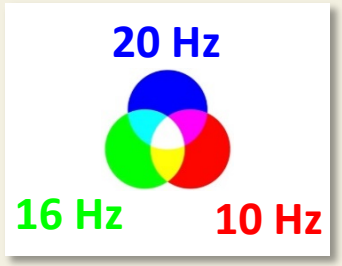
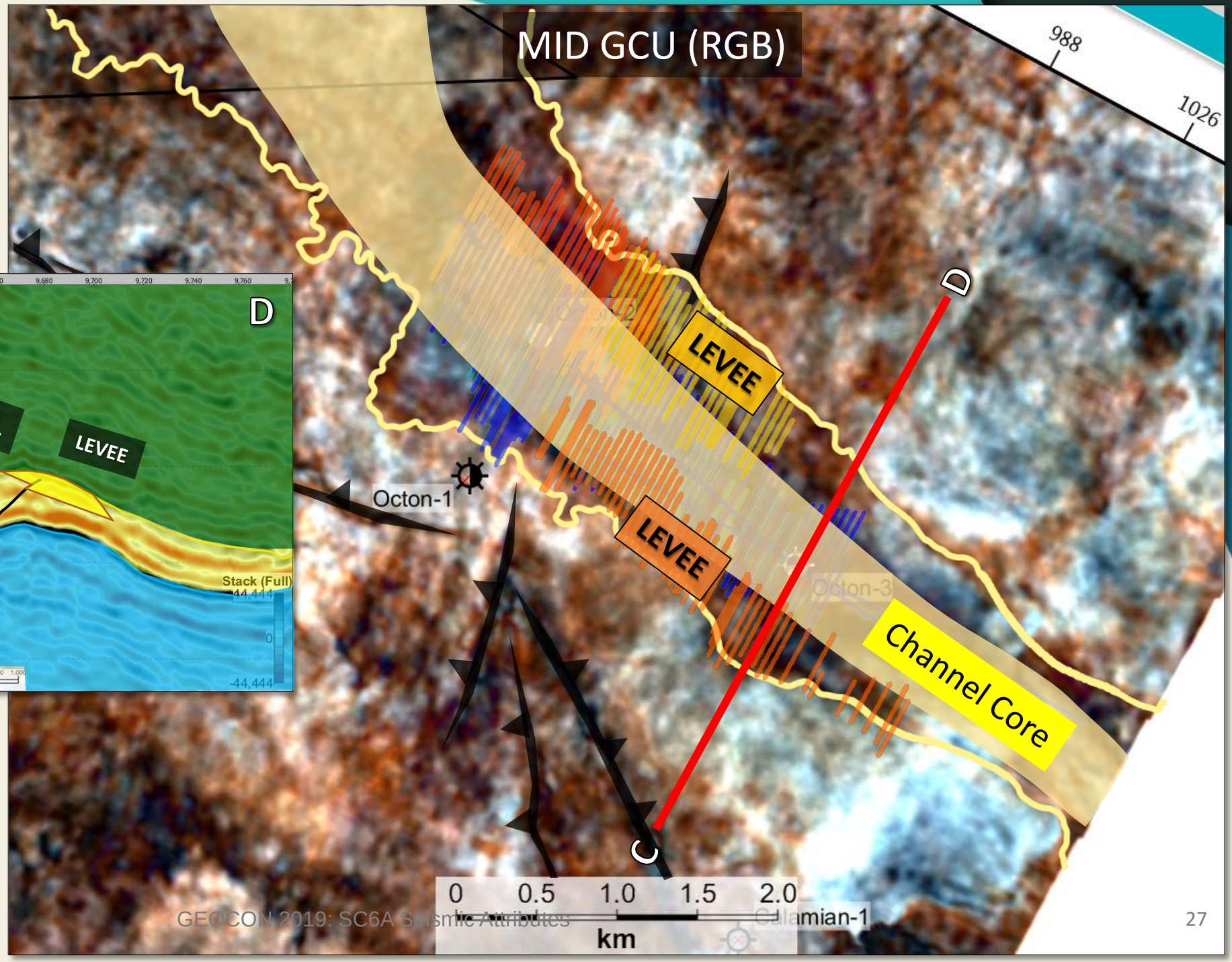
SOUTH BLOCK

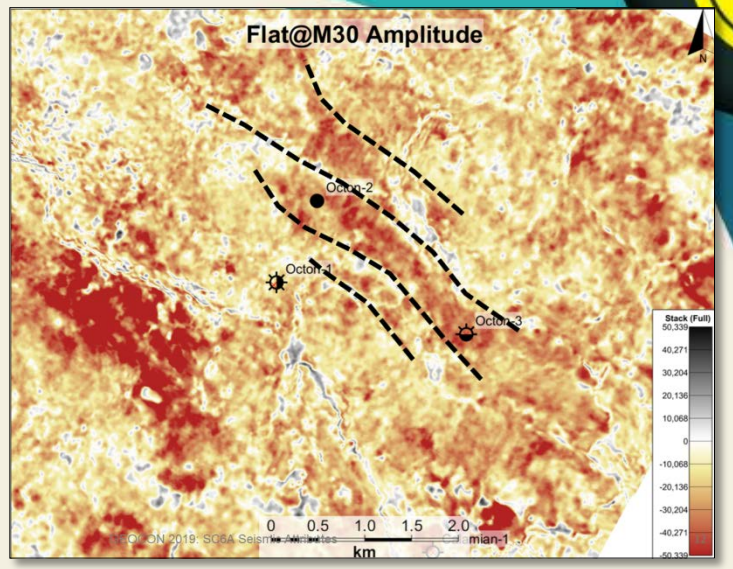


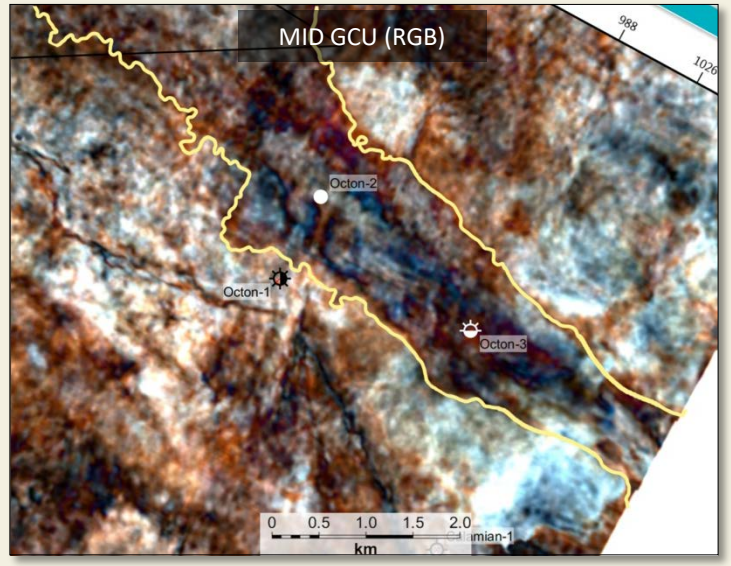




CONCLUSIONS

- Seismic attributes enable interpreters to extract more out of the seismic data.
- Spectral decomposition is an effective tool for delineating sedimentological features below the seismic resolution.
  - Best applicable to channel geometries in relatively benign tectonic settings.
  - Should be **targeted**:
    - Horizon pick should be chronostratigraphically accurate
  - Hard to do in structurally complex areas
    - Poor seismic
    - Difficult to map





THANK YOU!

Department of Energy

Service Contract 6A Consortium

The Philodrill Corporation

PetroEnergy Resources Corp

Anglo Philippine Holdings Corp

ACE Enexor Inc

Forum Energy Phils. Corp

PXP Energy Corp

Alcorn Petroleum and Minerals Corp

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